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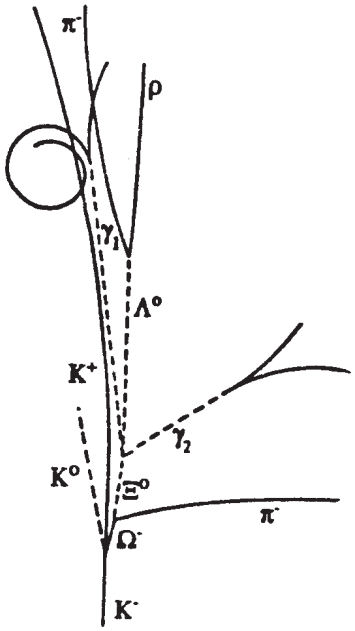

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THE NEW SCIENCES AND TECHNOLOGIES FOR THE PURIFICATION OF URBAN AIR

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Abstract

Air pollution is nowadays a too well-known problem for big cities with high population density. Among the most dangerous pollutants for public health, we can find hydrocarbons, carbon monoxide, nitrogen dioxide, sulfur dioxide, and other pollutants that can cause breathing dysfunctions and various diseases, sometimes fatal. Most of these pollutants are a direct or indirect consequence of the burning processes of fossil fuels. The problem is rather complex because atmospheric pollution cannot be decreased by just decreasing the use of fossil fuels for heating, cooking and automotive usage. In this paper, the first names author (S. B. B.) outlines decades of research and development, as well as significant investment, that have led the U. S. publicly traded company Thunder Energy Corporation the development of basically new sciences and technologies for the production and sale of Urban Air Purificators(TM) comprising: equipment for the intake of polluted urban air in large volumes; equipment for the elimination of all combustible pollutants, including hydrocarbons, carbon monoxide and others without catalytic converters or scrubbers; and means for final filtration and processing so as to release in urban environments, including individual houses, clean breathable air without appreciable toxic contaminants, essentially given by nitrogen, oxygen, carbon dioxide and traces of other non-toxic gases in parts per millions. The new sciences for the achievement of these features included a generalization of quantum chemistry known as hadronic chemistry, including the discovery of the new chemical species of magnecules, and the development of the novel HyperFurnaces(TM) that eliminate toxic contaminants without catalytic converters or other conventional means, via the local achievement of temperatures of the order millions of degrees thanks to basically novel nuclear processes.

Based on invited talk at SIPS 2016, Santilli International Symposium on Sustainable Applications, Hainan Island, China, November 6 -10, 2016.

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1. Foreword

*"26 MAY 2015 ¦ GENEVA - The **World Health Assembly** closed today, with Director-General Dr Margaret Chan noting that it had passed several "landmark resolutions and decisions". Three new resolutions were passed today: **one on air pollution,** one on epilepsy and one laying out the next steps in finalizing a framework of engagement with non-State actors.*

Air pollution

*Delegates at the **World Health Assembly** adopted a resolution to address the health impacts of air pollution – the world's largest single environmental health risk. Every year 4.3 million deaths occur from exposure to indoor air pollution and 3.7 million deaths are attributable to outdoor air pollution. This was the first time the Health Assembly had debated the topic. [...]"* [1]

2. Summary

Air pollution is contamination of the indoor or outdoor environment by any chemical, physical or biological agent that modifies the natural characteristics of the atmosphere. Household combustion devices, motor vehicles, industrial facilities and forest fires are common sources of air pollution. Pollutants of major public health concern include particulate matter, carbon monoxide, ozone, nitrogen dioxide and sulfur dioxide. Outdoor and indoor air pollution cause respiratory and other diseases, which can be fatal. [2]

A new World Health Organization air quality model confirms that 92% of the world's population lives in places where air quality levels exceed WHO limits. The new data represents the most detailed outdoor air pollution-related health data, by country, ever reported by WHO. [3]

The urban atmosphere of cities around the world represents a real and immediate problem for the health of citizens because of their high content of carcinogens and toxic dust originating from the excessive burning of fossil fuels.

The situation is therefore very complex, because, as cities are becoming a major risk for the health of citizens, on the one hand you cannot reduce motor traffic without causing serious damage to the economy and to local activities and, on the other hand, it is not realistic to think of a complete elimination of fossil fuels in favor of new cleaner fuels. The only logical solution possible is the treatment of urban atmospheres,

defined herein, consisting in: the carbonization of all gaseous or solid toxic substances; and the release into the atmosphere of the natural gases only, with the remainder being released in a controlled and ecologically acceptable manner.

In this paper it is shown that the technologies for urban purification of the atmosphere are already available on an industrial scale, and simply require their coordination and specialization to the problem considered. We therefore present the project of the first Pilot Plant for the Treatment of Urban Atmosphere, indicating the major political and industrial benefits that would result from implementation of the project because of the expected worldwide interest.

3. Lack of data on urban atmosphere composition

At the beginning of last century, the Earth's atmosphere had the following constitution:

=> 78,08% Nitrogen (N_2),
=> 20,94% Oxygen (O_2),
=> 0,93 % Argon (Ar),
=> 0,03% Carbon Dioxide (CO_2),
=> 0,02 % Neon (Ne), and the remaining
=> 0,01% consisted of various inert gases

(see Ref [4])

There are no corresponding official data for today's atmospheric composition in general, not only of the urban one, for many reasons, including a strong increase of carbon dioxide with estimates ranging from 100% to 500%, depending on the political orientation of the data sources themselves, an unknown decrease of O_2 transformed in excess CO_2 by the global burning of billions of liters of fuel per day

It's anyway obvious and undeniable that urban atmospheric composition of any metropolis experiences very sensitive localized variations with peaks that can be extremely harmful to the health of all living species and in particular of the human one.

Official figures are still not well known because they vary over time and from place to place, so it is difficult to have truly reliable global statistics. In fact, large cities with high population density and intense urban traffic have decreased local oxygen and a local increase of carbon dioxide and pollutants clearly higher than the corresponding data also in nearby countryside.

The consequences of prolonged exposure of humans in these highly polluted areas, can only be fully assessed in the long run, but we cannot ignore the scary data from the W.H.O. (World Health Organization). [1]

Given this great lack of data, the first step should be the conduction of systematic and accurate measurements of the atmospheric components of the city "sample" at different times of the day and of the year (with or without heating working, at maximum and minimum traffic levels etc.), without which no precise technical finalization of this project is possible.

4. Operating Principles

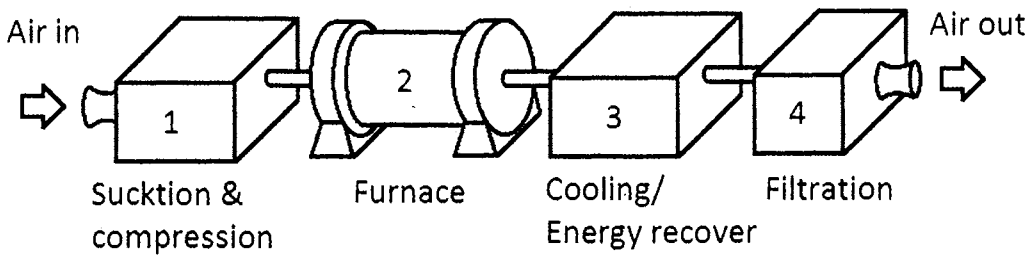

Figure 1: A schematic view of the four stations of the Urban Air Purificator

With reference to Figure 1, the Pilot Plant here proposed is based on the realization of the following stations:

FIRST STATION: with the purpose of drawing the urban air in, compress it to the required pressure, and transfer it with all pollutants to the next one;

SECOND STATION: with the purpose of burning all combustible components contained in contaminated urban air, such as carbon ,monoxide, hydrocarbons, biocontaminants, et al. and reducing them below detectable levels.

THIRD STATION: with the purpose of transforming the excess heat into energy and cooling down the substances originating from the second station

FOURTH STATION: with the purpose of separating the residual pollutants, returning clean air purified from all harmful substances.

FIFTH STATION: with the purpose of breaking the CO2 molecule

5. Available Technologies

The First Station is nowadays industrially known and normally produced.

The realization of the Second Station is now made possible by the technology of suitably designed high voltage and high power electric arcs, through which the gases are forced to pass. This technology is based on the same functioning principles of HyperFurnace™, whose rights are currently owned by Thunder Energies Corp. [5], although in this case they are used for the purification of air and not to burn fuel as in the original concept. In fact, among all the possibilities industrially feasible today, electric arc is by far the most efficient for the joint carbonization of carcinogenic substances, dust and of any other combustible toxic substances.

The third station makes use of parts produced on an industrial scale and easily available on the market.

The fourth station is made possible by a number of technologies for filtration and separation of solids from gases as they come out from the third station. There are, for example, HEPA filters, activated carbon filters, electrostatic precipitators, centrifugal separators such as Vortex Technology [6]. All of these technologies are fully developed and commonly used in industry. At the end of the process gaseous non-polluting substances are obtained together with carbonized substances usable for various industrial applications.

6. Purifucation of the atmosphere of a whole city

After the construction of the Pilot Plant and completion of additional studies, it is possible to proceed to the actual system design.

A reasonable number of industrial installations of this kind, arranged in strategic urban locations, for example in a radial pattern starting from the urban center, can expectedly depurate in one day the urban atmosphere contained in a layer of several tens of meters in height, thus sufficient for a significant urban atmosphere purification.

The correct sizing of the final plants will be possible after all the tests and measurements campaigns have been successfully performed.
In the medium term numerous substantial improvements are expected in the efficiency of these stations, in particular for the increase of the volume of purified atmosphere without an excessive increase of size and energy requirements.

It should be noted that the construction of a single large central plant for the purification of the whole city atmosphere is not recommendable because it would lose in efficiency, since the polluting substances are heavier than normal components of the atmosphere, for which they form the well-known layer visible to the naked eye, for example, at sunset, several tens of meters high.

A central high power plant therefore would end up with the aspiration of part of the non-contaminated air above the said layer. The use instead of a variety of industrial installations, distributed in the urban fabric, of a smaller size is much more effective for the purification of contaminated urban atmospheres, as well as being a more simple arrangement and with lower costs.

7. Structure of the first station

The main purpose of the first station is to suck the polluted atmosphere, compress it to the design operating pressure and transfer it to the next station.

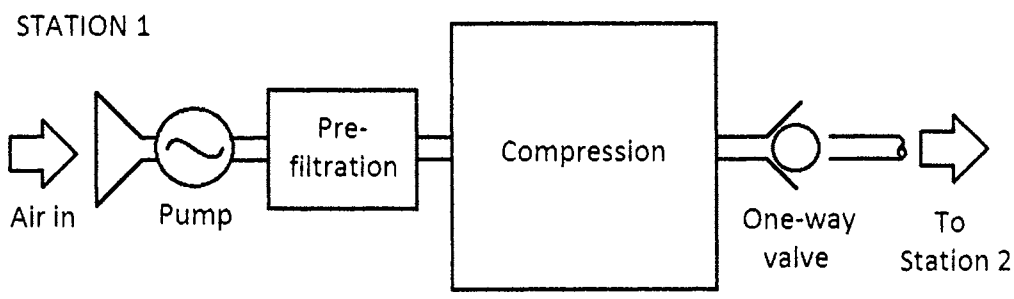

Figure 2: Scheme of the First Station

The first station must be able to aspirate the required volume of air, compress it and transfer it under pressure to the next station.
This result is nowadays obtainable by technologies established for decades, and that are easily available on the market.
With reference to Figure 2, the first station consists of a pump that sucks in the polluted urban air, performs a pre-filtering and passes it to the compressor that compresses it at the design pressure.

Figure 3 presents two examples of the many compressors available on the market.

Figure 3: View of two types of screw compressor normally available for sale.

8. Structure of the second station

The Second Station is designed and tested to burn all combustible components contained in contaminated urban air, such as carbon ,monoxide, hydrocarbons, biocontaminants, et al.

This function is achieved via a new combustion at high pressures and temperatures which is based on the activation of certain reactions without the emission of harmful radiations that, according to measurements by independent laboratories [5], are activated by a suitably modulated, high voltage, rapid DC arcs discharged through contaminated urban air at sufficiently high pressure, following the working principles of the above mentioned HyperFurnace™ [5].

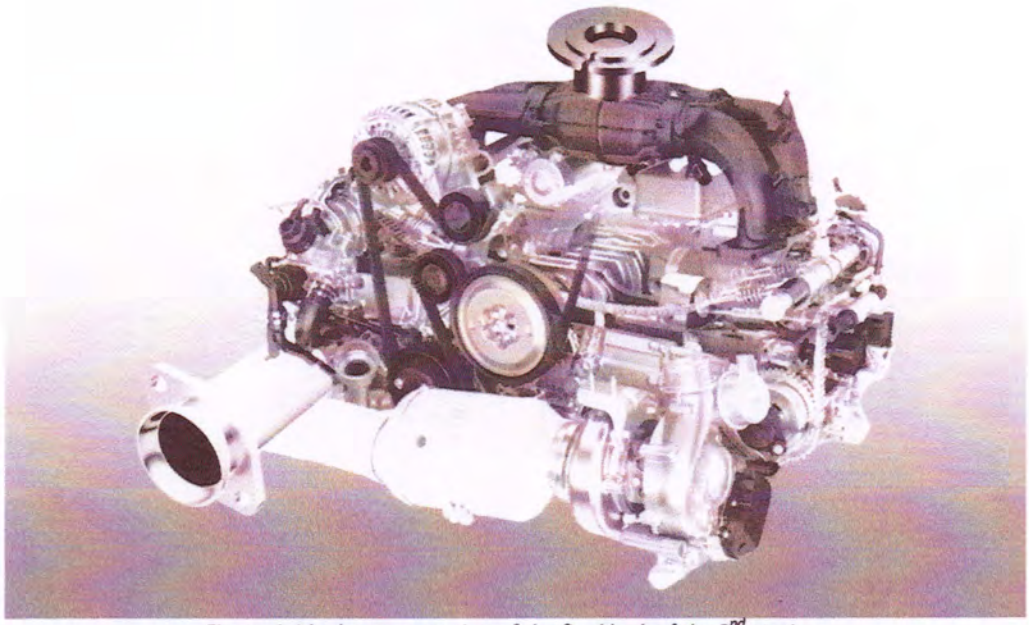

Figure 4: Ideal representation of the final look of the 2nd station

The high temperature air processed in the indicated way is then discharged by the engine through its exhaust manifold and released to the Third Station for its cooling.

9. Structure of the third station

After reaching the desired characteristics, the residual gas is released in the third station, which ensures the cooling of the superheated air and the generation of energy usable in different ways.

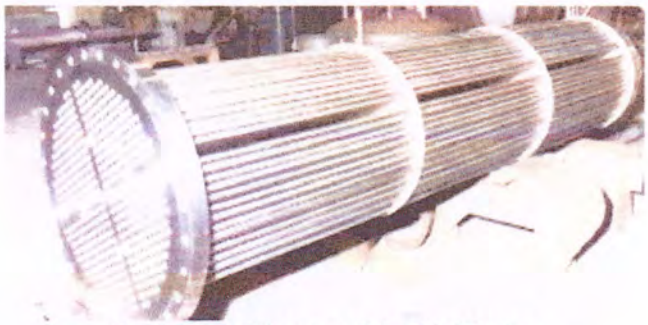

Figure 5: Possible setup of the Third Station

The actual structure of the third station will depend on the final design of the other ones.

10. Structure of the fourth station

Once the correct temperature of the air volume is reached, the latter is transferred to the fourth station where it is suitably filtered.

Of the volume of air to be treated the biggest part is expected to be made of the above purified air, but a small fraction is expected to be solid charred residues and non-combustible substances, both solid and gaseous.

The filtering of such impurities is nowadays allowed by various fully established technologies. The following are some examples:

- HEPA filters [7] (High Efficiency Particulate Air filters), which are composed of sheets of filtering microfibres assembled in multiple layers and separated by septa and aluminum and are known for their high performance in filtering the solid particles in the air flows;
- Vortex Technology [6], which allows to separate solid particles from gas using centrifugal force, thus without need for filters;
- Activated carbon filters [8], which are also able to remove any gaseous contaminants from the air output from the third station.

The carbonaceous substances may be collected separately and used for a variety of environmentally acceptable uses, such as the production of electrodes for the PlasmaArcFlow™ technology.

Figure 6: Examples of differently shaped HEPA filtering units

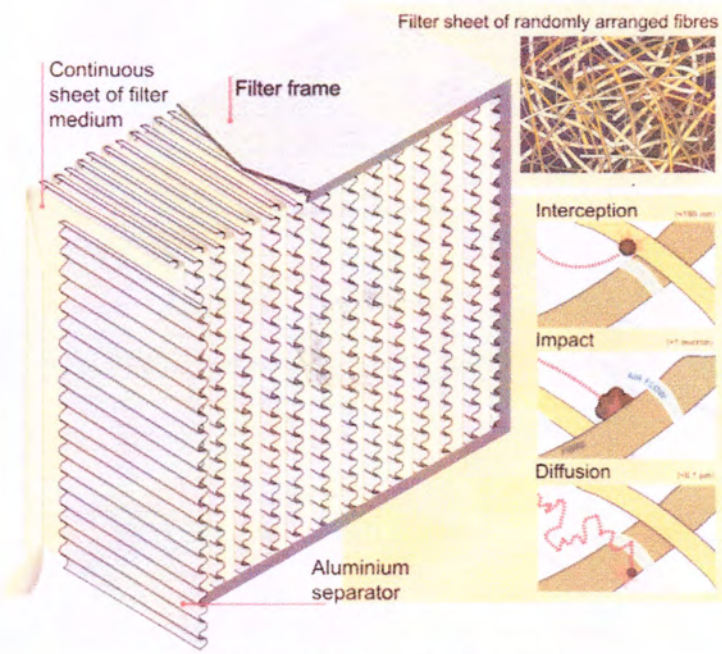

Figure 7: Scheme of a typical HEPA filter

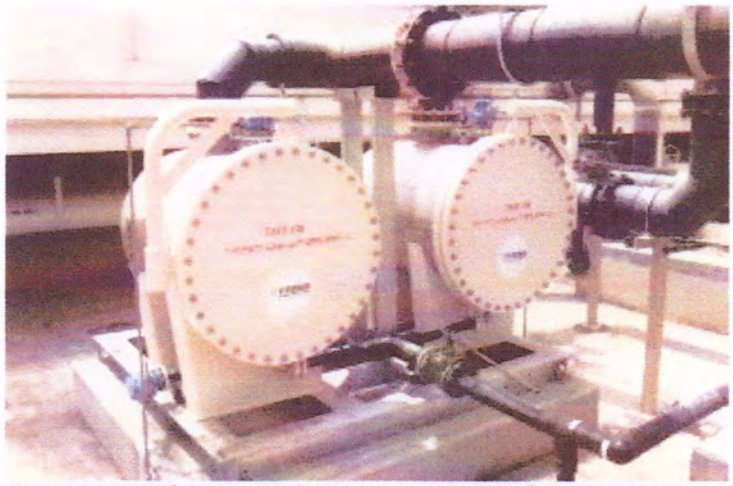

Figure 8: View of an industrial Vortex type separator for large production

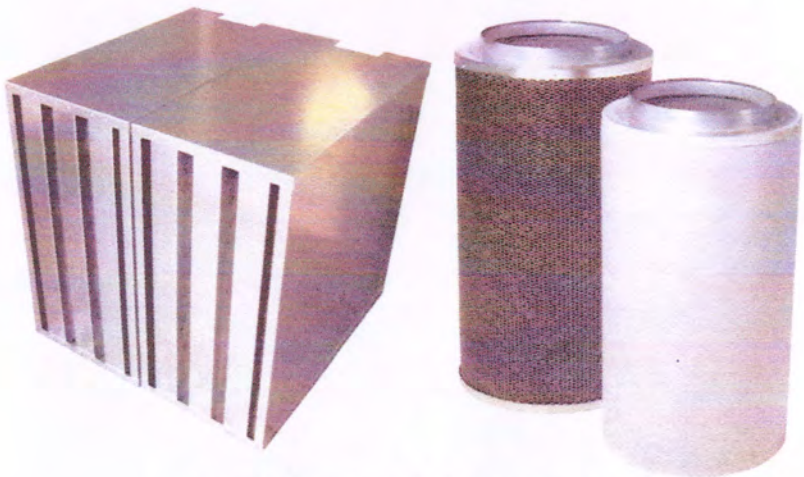

Figure 9: Examples of Activated carbon filters

It is also possible to find commercially already assembled filtering units [9], designed for the removal of the main pollutants harmful to human health, such as particulates, NO2, SO2, O3, VOC (see Figure 10).

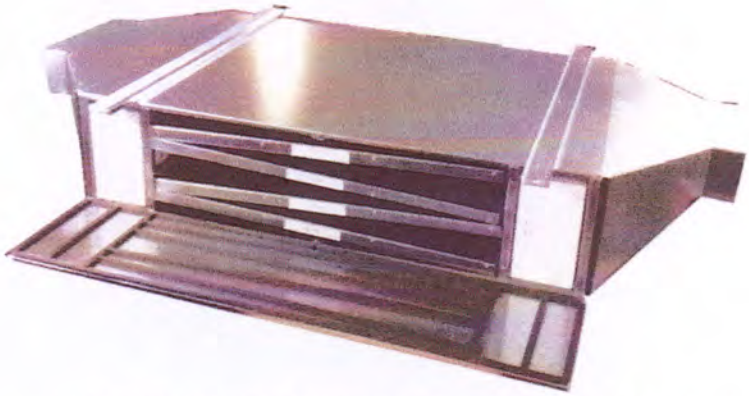

Figure 10: Example of commercially available air filtering unit

11. Political and industrial implications

Air pollution is the main cause of more and more frequent and violent phenomena that affect the quality of life and it's one of the main risk factors for the health of the population in urban areas. In this regard, as shown in the introduction, the World Health Organization (WHO), in a recent paper, concluded that the urban environment pollution is responsible each year of about 8,000,000 deaths in Europe alone [10]. According to the estimate of WHO, air pollution in Europe represents the main environmental risk factor, globally the eighth most important cause of death [11]. Similar indications come from the project "Air Pollution and Health: European Information System" (APHEIS), a study funded by the European Commission on the impact of air pollution in 29 European cities. According to this study, a reduction of the pollution due to PM10 (particulate matter of less than 10 micrometers particle size) of only 5 g / m3 could prevent about 5,000 deaths per year in the population covered by the survey (a total of 32 million citizens) [12].

The Political Parties, and especially the Politicians that play a leading role in Countries, Regions and Municipalities, must nowadays face this general framework.
Indeed, while there is on one hand an increasing number of complaints filed to the Judiciary by associations and groups of citizens that believe the institutions do not sufficiently protect the right to health, on the other hand it is clear that the quality of life and health protection will become critical matters driving future electoral choices. It is therefore of great interest to those who carry out political activities to have a thorough understanding of environmental issues and operate in order to be able to demonstrate, even in front of the judges, that they acted in the interest of the Community administration.

But also other aspects deserve to be highlighted, namely the business ones.

In fact, the system here suggested, with the applied technology and the expected results, will generate in the world great interest from all communities with high human activity that will see the development of a system actually able for the first time to clear all pollutants and fine dust components from the air. Furthermore, while getting more visibility, the product will also generate more interest by the world of industrial production, that will see in this solution the possible key to make the work environment more attractive to their workers.
As it can be easily imagined, moreover, additional benefits will be provided to the territory thanks to the industrial development of these plants that will generate jobs and contribute to income generation.
The publicity and image will allow for wide dissemination of this solution and will allow investors an excellent profitability of the investment made.

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ISONILPOTENTS AND SELF-ORGANIZATION

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Abstract

A significant aspect of sustainable development requires understanding of the spontaneous behaviour of natural systems, especially in terms of self-organization and self-assembly. If we understand how these processes occur in nature we can begin to replicate them with maximum efficiency and in the most sustainable way. My own work shows that, using evidence from mathematics, computational and systems theory, physics, chemistry, biology and ecology indicates that self-organization in Nature follows a route involving a dual-space nilpotent structure, which immediately connects any organized system with its environment in a completely definable way. The mathematics of this is exact and operates on every scale from the quantum level to galactic clusters, and involves both living and non-living structures. A significant development in this work is a connection to the isomathematics of R. M. Santilli, which, when applied to physics, is concerned with typically extended sources, for example involving media, etc., where conventional quantum mechanics and special relativity no longer hold, and where technological applications become important. The isonilpotent structures which emerge from this connection have many potential applications where self-organization is an important process.

Keywords: Self-organization; Dual space; Nilpotent quantum mechanics; Isomathematics; Isonilpotent.

Based on invited talk at SIPS 2016, Santilli International Symposium on Sustainable Applications, Hainan Island, China, November 6 -10, 2016.

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1 A universal alphabet and rewrite system

Sustainable development could be enhanced considerably if we had an extensive knowledge of the spontaneous behaviour of natural systems. Among the most important aspects are self-organization and self-assembly. Such processes have been extensively studied and described but no general explanation has been put forward to explain such behaviour. If we could understand the general principles behind such and how they occur in nature, in physical, chemical and biological systems, we could begin to develop methods of replicating them with maximum efficiency and in ways that would maximise sustainability.

The fact that we have discovered general laws and systems that we can apply to many aspects of Nature suggests that there is something like a 'program' which determines why one event follows another, though quantum mechanics suggests that this may not be 'deterministic' in the classical sense. We have made huge progress since the mid-twentieth century in building machines run on programs based on digital logic which can outperform humans in many logically deductive tasks. Such machines use sequential syntactical programming within a fixed environment and with a fixed set of rules. However, this does not appear to be how Nature operates itself, for there the environments change continually and semantics (which is absent from digital programming) is as important as syntactics. In addition, the concept of 'emergence' at higher orders of structure suggests that even the rules of operation may be evolutionary in some way.

Now, computer programming as we currently know it can be structured on the concept of a Turing machine and a rewrite or production system. Here, fixed production rules are used on a fixed set of components (an 'alphabet') to show how a system based on them evolves. The only other things we need to know to describe the complete evolutionary process are how to start and stop it. All standard computer programming can be expressed in this way. So a conventional rewrite system has 4 fixed components:

alphabet
rewrite rules (productions)
a start 'axiom' or symbol
stopping criteria

A simple example of how this operates would be a process for generating Fibonacci numbers. Here, there is an alphabet with just 2 symbols A and B, to which are applied just two production rules: p1: A → B; p2: B → AB. We could start at generation N = 0, with the single symbol A. If we apply rule p1, in generation 1, we replace A with B. In generation 2, A will became B, and B will become AB. We can continue with this process until we decide to stop at some arbitrary point, and we will find that we have generated a series of strings, whose lengths are successive Fibonacci numbers:

N=0	A	length	1
N=1	→B		1
N=2	→ AB		2
N=3	→ BAB		3
N=4	→ ABBAB		5
N=5	→ BABABBAB		8
N=6	→ ABBABBABABBAB		13
N=7	→ BABABBAB...		

Fibonacci numbers are everywhere in Nature, and the rules A → B and B → AB are essentially those of 3-dimensional algebra ($i \rightarrow j$; $j \rightarrow i\ j = k$), though confined to the plane. They are contained within Nature but they do not contain the whole of Nature's program. Is there any way of finding a more universal system, one which follows 'logical' rules, but is less confined, and which reflects the fact that Nature does not have fixed systems? Some time ago, Bernard Diaz and I found a system which extended the rewrite principle to a universal one, formed from the four same components (alphabet, rules, start and stop), but with none of them fixed. What determined the behaviour of this system was a more fundamental universal principle, that the sum total of everything in Nature, 'physical' and conceptual, was at all times and in all states of evolution exactly zero [1-4].

If the alphabet can be varied, then we can begin with an alphabet that is the same as the start object. The rules will then refer to the extension of this alphabet, so the creation of a new alphabet will determine the rules. And, since Nature's process is indefinite, then the stopping procedure will merely refer to an arbitrary point in the sequence. The whole process is then defined entirely by the alphabet, and this will always total to zero. The principal and unique

assumption, then, is an infinitely degenerate state of zero totality, that is one with no unique description, and this alphabet has to be continually described in such a way that each description is always new, and in each case zero. So, there is no fixed start or end, but each position within the process defines a new zero structure. So any non-zero deviation from 0, say R, necessarily incorporates an automatic mechanism for recovering the zero, say a 'conjugate' R^*. The zero totality (R, R^*), however, does not define a *unique* zero, and must always define a new structure.

There is only one way of ensuring that the new structure is new. This is by incorporating the old structure as an intrinsic component of the new ones. Each new structure becomes a new zero 'cardinality', which, like the infinite cardinalities of Cantor, is a totality including all previous ones. A convenient, though not definitive, way of displaying the process is by using the 'concatenation' or placing together, with no assumption of algebraic significance, of the alphabet with respect to either its component 'subalphabets' or itself. An alphabet that describes a cardinality or totality necessarily requires anything other than itself to be a component or 'subalphabet'. In this case, the concatenation will yield nothing new. However, if the alphabet is concatenated with itself, the only other option, can only ensure that the cardinality of the original alphabet is not unique, by producing a new cardinality or zero totality alphabet.

It is convenient to define two condition. *Create*, symbolised by $\Rightarrow$, means that every alphabet produces a new one, subsuming itself as a component. *Conserve*, symbolised by $\rightarrow$, means that nothing new is created unless the alphabet is extended. Creation is always of a new zero totality. The process is both iterative and recursive. It is also fractal, beginning or ending at any stage, with self-similarity at all stages. Since, as we have shown, it describes / creates both time and 3D space, the process may be thought of as prior to both. Using these two conditions, the requirement of non-unique cardinality ensures that

(subalphabet) (alphabet) $\rightarrow$ (alphabet)	*there is nothing new*
(alphabet) (alphabet) $\Rightarrow$ (new alphabet)	*the zero totality not unique*

The two conditions are not independent. The new alphabet produced by $\Rightarrow$ must simultaneously satisfy $\rightarrow$ in all possible cases. We will only know what a new alphabet will look like when we have worked out all the ways in which

concatenation with its subalphabets will yield only itself. So, let us suppose that our first zero totality alphabet has the form (R, R^*). Applying the conserve principle ($\rightarrow$) by concatenating it with its subalphabets should produce nothing new. So

$$(R)\,(R, R^*) \rightarrow (R, R^*)$$
$$(R^*)\,(R, R^*) \rightarrow (R^*, R) \equiv (R, R^*)$$

As we will see, no concept of ordering' is required by concatenation, but each term must be distinct, so, while the versions of the alphabet produced by these 'conserve' concatenations are identical in totality, an ordering of the terms is introduced which indicates which subalphabet is involved, in this case (R) or (R^*). We can easily show that these concatenations lead to rules of the form:

$$(R)\,(R) \rightarrow (R)\,;\,(R^*)\,(R) \rightarrow (R^*)\,;$$
$$(R)\,(R^*) \rightarrow (R^*)\,;\,(R^*)\,(R^*) \rightarrow (R)$$

Now, the zero-totality alphabet $(R,\ R^*)$ cannot be unique, and concatenation with itself (i.e. 'creation') must produce a new conjugated or zero totality alphabet, which includes (R, R^*) as a component. An alphabet of the form $(A,\ A^*)$, with the terms undefined, would be indistinguishable from $(R,\ R^*)$, but one including $(A,\ A^*)$ would be distinguishable from $(R,\ R^*)$ if it also *included* it. However, this more inclusive alphabet must still preserve the conserve mechanism, which means that the subalphabets yield nothing new. So we try

$$(R, R^*)\,(R, R^*) \Rightarrow (R, R^*, A, A^*)$$

Applying the conserve mechanism ($\rightarrow$) to this new alphabet, by concatenation with the subalphabets, produces

$$(R)\,(R, R^*, A, A^*) \rightarrow (R, R^*, A, A^*) \equiv (R, R^*, A, A^*)$$
$$(R^*)\,(R, R^*, A, A^*) \rightarrow (R^*, R, A^*, A) \equiv (R, R^*, A, A^*)$$
$$(A)\,(R, R^*, A, A^*) \rightarrow (A, A^*, R^*, R) \equiv (R, R^*, A, A^*)$$
$$(A^*)\,(R, R^*, A, A^*) \rightarrow (A^*, A, R, R^*) \equiv (R, R^*, A, A^*)$$

As before, the order of the terms is different, but the final total alphabet is the same.

It soon becomes apparent that (R, R^*) and (A, A^*) can only be different if

$$A\,A \rightarrow R^*, \text{ etc., while } R\,R \rightarrow R$$

If we had made $A\ A \rightarrow R$, then A would have been indistinguishable from R and the alphabet would not have been extended. The significance of this will become apparent when we introduce an algebraic interpretation.

At the next stage, there is a new problem, for

$$(R, R^*, A, A^*)\,(R, R^*, A, A^*) \Rightarrow (R, R^*, A, A^*, B, B^*)$$

would lead to new concatenated *terms* like AB, AB^* when we apply the conserve mechanism ($\rightarrow$). So we have to include these in advance, as in

$$(R, R^*, A, A^*)\,(R, R^*, A, A^*) \Rightarrow (R, R^*, A, A^*, B, B^*, AB, AB^*)$$

But another complication arises when we successively perform the conserve operation with (R), (R^*), (A), (A^*), (B), (B^*), (AB), (AB^*), to leave the totality unchanged. The process is straightforward for the first six operations:

$$\begin{aligned}
&(R)\,(R, R^*, A, A^*, B, B^*, AB, AB^*) \rightarrow (R, R^*, A, A^*, B, B^*, AB, AB^*)\\
&(R^*)\,(R, R^*, A, A^*, B, B^*, AB, AB^*) \rightarrow (R^*, R, A^*, A, B^*, B, AB^*, AB)\\
&(A)\,(R, R^*, A, A^*, B, B^*, AB, AB^*) \rightarrow (A, A^*, R^*, R, AB, AB^*, B, B^*)\\
&(A^*)\,(R, R^*, A, A^*, B, B^*, AB, AB^*) \rightarrow (A^*, A, R, R^*, AB^*, AB, B^*, B)\\
&(B)\,(R, R^*, A, A^*, B, B^*, AB, AB^*) \rightarrow (B, B^*, AB, AB^*, R^*, R, A, A^*)\\
&(B^*)\,(R, R^*, A, A^*, B, B^*, AB, AB^*) \rightarrow (B^*, B, AB^*, AB, R, R^*, A^*, A)
\end{aligned}$$

The real problem arises when we apply the process using the concatenated terms, such as (AB) and (AB^*) on themselves and on each other. There are two clear possibilities for the concatenation $(AB)\,(AB)$, and we can regard these as the 'commutative' and 'anticommutative' options:

$$\begin{aligned}
&(AB)\,(AB) \rightarrow (R) && \textit{commutative}\\
&(AB)\,(AB) \rightarrow (R^*) && \textit{anticommutative}
\end{aligned}$$

However, there is really no choice, for *only the anticommutative option* leads to something new. The commutative option leaves A and B indistinguishable and so does not extend the alphabet. We are therefore obliged to default on the anticommutative option, and the last two concatenations become:

$$(AB)\,(R, R^*, A, A^*, B, B^*, AB, AB^*) \rightarrow (AB, AB^*, B, B^*, A, A^*, R^*, R)$$
$$(AB^*)\,(R, R^*, A, A^*, B, B^*, AB, AB^*) \rightarrow (AB^*, AB, B^*, B, A^*, A, R, R^*)$$

We have now solved the problem for A and B, but we cannot extend the process to include new terms, such as (C), (D), etc., when the alphabet is extended at higher stages because some inconsistency will always reveal itself at some point in the analysis. An anticommutative system is effectively a closed 'cycle' with components (A, B, AB) and their conjugates, no further C, D ...-type term can anticommute with them, except in the special case where we introduce antiassociativity as well. This, however, is also limited and will not take the process to infinity. We will not be able to produce an infinite system of unique zeros or cardinalities.

However, if we introduce the separate successive cycles, say, (A, B, AB), (C, D, CD), etc., *commutatively* into the structure, we can continue this indefinitely, and all the terms will have a unique identity *because they each have a unique partner*. In this formulation, the alphabets generated by the create process ($\Rightarrow$) lead to a regular series of identically structured closed anticommutative cycles, each of which commutes with all others. We are familiar with such a structure, as it is equivalent to the infinite series of finite (binary) integers of conventional mathematics. The closed cycles produce an infinite ordinal sequence, establishing for the first time within the current assumptions the meaning of both the number 1 and the binary symbol 1 as it appears in classical Boolean logic as a conjugation state of 0, and the infinite series of alphabets structure themselves as an infinite series of binary digits.

The iterative process of generating the alphabets can be represented in symbolic form in the table:

	0	Δ_a	Δ_b	Δ_c	...	Δ_n
0	00	$0\Delta_a$	$0\Delta_b$	$0\Delta_c$		$0\Delta_n$
Δ_a	$\Delta_a 0$	$\Delta_a\Delta_a$	$\Delta_a\Delta_b$	$\Delta_a\Delta_c$		$\Delta_a\Delta_n$
Δ_b	$\Delta_b 0$	$\Delta_b\Delta_a$	$\Delta_b\Delta_b$	$\Delta_b\Delta_c$		$\Delta_b\Delta_n$
Δ_c	$\Delta_c 0$	$\Delta_c\Delta_a$	$\Delta_c\Delta_b$	$\Delta_c\Delta_c$		$\Delta_c\Delta_n$
:						
Δ_n	$\Delta_n 0$	$\Delta_n\Delta_a$	$\Delta_n\Delta_b$	$\Delta_n\Delta_c$		$\Delta_n\Delta_n$

Here, the Δ symbols represent the alphabets:

Δ_a	(R)
Δ_b	(R, R^*)
Δ_c	(R, R^*, A, A^*)
Δ_d	$(R, R^*, A, A^*, B, B^*, AB, AB^*)$
Δ_e	$(R, R^*, A, A^*, B, B^*, AB, AB^*, C, C^*,$ $AC, AC^*, BC, BC^*, ABC, ABC^*)$ ...

What we have succeeded in deriving here can be regarded as a universal system of pure process, independent of algebra, arithmetic, digital logic, set theory, and any other defined system based on fixed rules and parameters, although all of these would be natural developments from it. Mathematics and digital logic, and the integer series, do not need to be assumed as starting-points for analysis, with all the undecidability problems that this introduces. They can instead be regarded as emergent properties of an ongoing rewrite process with no specific defined starting point that can be reconstructed endlessly in a fractal manner with self-similarity at all stages.

Also, once we have integers, the rest of the constructible number system follows automatically by successive application, together with arithmetical operations, such as addition and multiplication. In addition, application of the constructed number systems to the undefined state with which the process begins indicates that, because it is not intrinsically discrete, it can be interpreted in terms of a continuity of real numbers in the Cantorian sense. In the construction, also, anticommutativity can be seen, fundamentally, as the same as 3-dimensionality. The fact that the uniqueness requirement forces us to introduce anticommutativity, means that the concepts of *discreteness* and *dimensionality* (specifically 3-dimensionality) are constructed simultaneously.

In the physical world, as we will see, 3-dimensionality requires discreteness, and discreteness requires 3-dimensionality. 3-dimensionality, or anticommutativity, becomes the ultimate source of discreteness in a zero totality universe.

2 An algebraic interpretation

Many applications can be derived for this universal system of process. the system generates its own arithmetic and algebra, one that becomes immediately apparent is an algebra which replaces R with the real unit 1 and R^* with -1. (A, B, AB), (C, D, CD), (E, F, EF), etc. become the mutually commutative sets of quaternion units ($i_1, j_1, i_1j_1 = k_1$), ($i_2, j_2, i_2j_2 = k_2$), ($i_3, j_3, i_3j_3 = k_3$) ..., and, since the system does not fix values, each of these can be attached an arbitrary scalar coefficient. So the stages of the process, with concatenation interpreted as multiplication, could be written in the form:

$$
\begin{aligned}
&(1, -1)\\
&(1, -1) \times (1, i_1)\\
&(1, -1) \times (1, i_1) \times (1, j_1)\\
&(1, -1) \times (1, i_1) \times (1, j_1) \times (1, i_2)\\
&(1, -1) \times (1, i_1) \times (1, j_1) \times (1, i_2) \times (1, j_2)\\
&(1, -1) \times (1, i_1) \times (1, j_1) \times (1, i_2) \times (1, j_2) \times (1, i_3) \ldots
\end{aligned}
$$

Further investigation will show, in line with the fractal nature of the process, that combinations of lower order alphabets will produce higher order ones, so that the sixth alphabet would be a natural result of the first four *treated as independent units*, and the fourth of the first three, also that the whole series begins to repeat itself at the fourth order. The algebraic series is also, recognizably, a representation of an infinite Clifford algebra series. Where a quaternion unit remains unpaired, it behaves like an ordinary complex i unit, and, where an incomplete quaternion system, combines with a complete one, a complexified quaternion or multivariate vector emerges. This is the algebra of 3-dimensional space. So, the first six alphabets in the algebraic representation would be:

scalar algebra
complex algebra
quaternions
complexified quaternions = multivariate vectors
double quaternions
complexified double quaternions = multivariate vector quaternions

The last could also be represented as double multivariate vectors. Multivariate or 3-D Clifford algebra vectors also incorporate the three lower algebras as subalgebras, the quaternions being equivalent to pseudovectors or bivectors and the complex terms as pseudoscalars or trivectors.

The completely multiplied out version of the units of the first four alphabets (with $\boldsymbol{i}_1\boldsymbol{j}_1 = \boldsymbol{k}_1$, etc.) would be + and – versions of

$$1$$
$$1, \boldsymbol{i}_1$$
$$1, \boldsymbol{i}_1, \boldsymbol{j}_1, \boldsymbol{k}_1$$
$$1, \boldsymbol{i}_1, \boldsymbol{j}_1, \boldsymbol{k}_1, \boldsymbol{i}_2, \boldsymbol{i}_1\boldsymbol{i}_2, \boldsymbol{j}_1\boldsymbol{i}_2, \boldsymbol{k}_1\boldsymbol{i}_2, \text{etc.}$$

Translating this into the symbols of complex numbers (for unpaired quaternions), quaternions and multivariate vectors, these alphabets become

$$1$$
$$1, i$$
$$1, \boldsymbol{i}, \boldsymbol{j}, \boldsymbol{k}$$
$$1, \boldsymbol{i}, \boldsymbol{j}, \boldsymbol{k}\ \mathbf{i}, \mathbf{j}, \mathbf{k}, i, \text{etc.}$$

If we write out the last as the algebra of 3-dimensional space, then we see that it has the base vector units (**i**, **j**, **k**), the pseudovector or bivector units which emerge as the products of orthogonal vectors (i**i**, i**j**, i**k**), which are equivalent to the quaternion units ($\boldsymbol{i}$, $\boldsymbol{j}$, $\boldsymbol{k}$), and which, in physical terms, represent areas, and the pseudoscalar units which emerge from the products of pseudovectors and parallel vectors (i), and which, in physical terms, represent volumes. So, the full algebraic description of a vector space, including its ability to generate areas and volumes, can be described by + and – versions of 8 base units:

i j k	vector		
i*i** (= ***i) ***i*j** (= ***j***) ***i*k** (= ***k***)	bivector	pseudovector	
	quaternion		(area)
i	trivector	pseudoscalar	(volume)
1	scalar		

3 Application to physics

The fact that the system becomes repetitive with the algebra usually applied to 3-D space also suggests that it might apply to the physical world as well. In this case, we would expect each successive alphabet to have a physical meaning, and for each to be independently valid at the same time. However, the creation of a repeating unit at a certain stage could indicate that the alphabet doesn't need to be extended indefinitely to describe a physical system, but that we can use the repetition and self-similarity built into the structure, with the first four alphabets combined into a repeating unit. Now, there are just four fundamental physical parameters from which physics can be constructed, and these have algebras which correspond to the first four alphabets [3-5]. These are mass(-energy), time, charge and space (where charge is taken as the source of all three gauge interactions), and their respective algebras are scalar, complex (= pseudoscalar or trivector), quaternion (= pseudovector or bivector), and multivariate vector.

Combining them as independent descriptions of reality leads to the algebra which corresponds to the alphabet of the sixth order. This is a double Clifford algebra, or the algebra of a double 3-D space. It is also mathematically equivalent to a complexified double quaternion algebra or a vector quaternion algebra. It is additionally the precise algebra (isomorphic to the gamma matrices) needed to describe fermions or the particles represented by the Dirac equation of relativistic quantum mechanics. Physics has not so far progressed beyond a system in which Dirac fermions are the ultimate units. In the current state of physics, the universe is described solely by such particles and their interactions (which imply the existence also of exchange particles or bosons). Nothing is known which lies outside this description. Space, time and interactions are essentially manifestations of fermion structure, and solving fermion structure would lead to an understanding of the basis of physics, and, by implication, everything that builds upon it, including chemistry and biology.

In this model, we take the 8 basic units of time, space, time and charge:

$\boldsymbol{i}$	$\mathbf{i}, \mathbf{j}, \mathbf{k}$	1	$\boldsymbol{i}, \boldsymbol{j}, \boldsymbol{k}$
time	space	mass	charge

and take all possible algebraic products to create the 64-part vector-quaternion algebra, with units:

1	i				-1	$-i$			
$\boldsymbol{i}\mathbf{i}$	$\boldsymbol{i}\mathbf{j}$	$\boldsymbol{i}\mathbf{j}$	$i\mathbf{k}$	$\boldsymbol{j}$	$-\boldsymbol{i}\mathbf{i}$	$-\boldsymbol{i}\mathbf{j}$	$-\boldsymbol{i}\mathbf{j}$	$-i\mathbf{k}$	$-\boldsymbol{j}$
$\boldsymbol{j}\mathbf{i}$	$\boldsymbol{j}\mathbf{j}$	$\boldsymbol{j}\mathbf{k}$	$\boldsymbol{i}\boldsymbol{i}$	$\boldsymbol{k}$	$-\boldsymbol{j}\mathbf{i}$	$-\boldsymbol{j}\mathbf{j}$	$-\boldsymbol{j}\mathbf{k}$	$-\boldsymbol{i}\boldsymbol{i}$	$-\boldsymbol{k}$
$\boldsymbol{k}\mathbf{i}$	$\boldsymbol{k}\mathbf{j}$	$\boldsymbol{k}\mathbf{k}$	$\boldsymbol{i}\boldsymbol{j}$	$\boldsymbol{i}$	$-\boldsymbol{k}\mathbf{i}$	$-\boldsymbol{k}\mathbf{j}$	$-\boldsymbol{k}\mathbf{k}$	$-\boldsymbol{i}\boldsymbol{j}$	$-\boldsymbol{i}$
$i\mathbf{i}\boldsymbol{i}$	$i\mathbf{i}\boldsymbol{j}$	$i\mathbf{i}\boldsymbol{k}$	$i\mathbf{k}$	$\mathbf{j}$	$-i\mathbf{i}\boldsymbol{i}$	$-i\mathbf{i}\boldsymbol{j}$	$-i\mathbf{i}\boldsymbol{k}$	$-i\mathbf{k}$	$-\mathbf{j}$
$i\mathbf{j}\boldsymbol{i}$	$i\mathbf{j}\boldsymbol{j}$	$i\mathbf{j}\boldsymbol{k}$	$i\mathbf{i}$	$\mathbf{k}$	$-i\mathbf{j}\boldsymbol{i}$	$-i\mathbf{j}\boldsymbol{j}$	$-i\mathbf{j}\boldsymbol{k}$	$-i\mathbf{i}$	$-\mathbf{k}$
$i\mathbf{k}\boldsymbol{i}$	$i\mathbf{k}\boldsymbol{j}$	$i\mathbf{k}\boldsymbol{k}$	$i\mathbf{j}$	$\mathbf{i}$	$-i\mathbf{k}\boldsymbol{i}$	$-i\mathbf{k}\boldsymbol{j}$	$-i\mathbf{k}\boldsymbol{k}$	$-i\mathbf{j}$	$-\mathbf{i}$

The 64 units form a finite group of order 64, which could be generated by the 8 units of time, space, mass and charge, but using composite units from the table, we can reduce the minimum number of generators or starting units to 5. 12 sets of such generators are incorporated into the table. A typical example is from the first line following the complex units: $\boldsymbol{i}\mathbf{i}$, $\boldsymbol{i}\mathbf{j}$, $\boldsymbol{i}\mathbf{j}$, $i\mathbf{k}$, $\boldsymbol{j}$, but all other possible sets are identical in form, merely changing the symbols. The first set could be created from the 8 base units by attaching the units of charge (in the order, $\boldsymbol{k}$, $\boldsymbol{i}$, $\boldsymbol{i}$) to those of time, mass and space, to give:

$i\boldsymbol{k}$	$\boldsymbol{i}\mathbf{i}, \boldsymbol{i}\mathbf{j}, i\mathbf{k}$	$1\boldsymbol{j}$

This is precisely what physics does, as these new units (which are quantized because charge is quantized), codify a particle's

energy	momentum	rest mass
ikE	$\boldsymbol{i}\mathbf{p}$	$\boldsymbol{j}m$

where $\boldsymbol{i}\mathbf{p} = \boldsymbol{i}\mathbf{i}p_x + \boldsymbol{i}\mathbf{j}p_y + \boldsymbol{i}\mathbf{k}p_z$. Significantly, at this point, the symmetry of one of the two 3-dimensional structures ($\boldsymbol{i}, \boldsymbol{j}, \boldsymbol{k}$) is broken, while that of the other ($\mathbf{i}$, $\mathbf{j}$, $\mathbf{k}$) is preserved.

Remarkably, when we take ($\boldsymbol{ik}E + \boldsymbol{i}\mathbf{p} + \boldsymbol{j}m$) to represent a fundamental physical unit or particle, we find that it immediately solves the problem of indefinite extension of the alphabet. This is because ($\boldsymbol{ik}E + \boldsymbol{i}\mathbf{p} + \boldsymbol{j}m$) is a *nilpotent*, a square root of zero, and, if this object incorporates all the alphabets needed to create a repetitive sequence, then, when we generate the next alphabet by squaring, we will find that it is automatically zeroed, so zeroing all higher alphabets which incorporate it. The world can then be described through an indefinite succession of such units.

Physically, the equation

$$(\boldsymbol{ik}E + \boldsymbol{i}\mathbf{p} + \boldsymbol{j}m)\,(\boldsymbol{ik}E + \boldsymbol{i}\mathbf{p} + \boldsymbol{j}m) = 0$$

is simply the relativistic and quantum mechanical conservation of energy and momentum. Classically, this becomes Einstein's energy-momentum conservation equation

$$E^2 - p^2 - m^2 = 0,$$

which is written

$$E^2 - p^2c^2 - m^2c^4 = 0$$

if we explicitly include the velocity of light c as a proportionality constant between the units. Quantum mechanically, we take the E and $\mathbf{p}$ terms in the nilpotent as either the differential operators codifying the variations in time and space coordinates of the system's components or as the values of energy and momentum (or equivalent) that result from these operations. In quantum mechanics the operators operate on phase terms or functions of space and time which are completely defined once the operator is specified. The result is then a nilpotent amplitude of the form ($\boldsymbol{ik}E + \boldsymbol{i}\mathbf{p} + \boldsymbol{j}m$). As an example, if we apply a canonical quantization procedure to the first bracket in ($\boldsymbol{ik}E + \boldsymbol{i}\mathbf{p} + \boldsymbol{j}m$) ($\boldsymbol{ik}E + \boldsymbol{i}\mathbf{p} + \boldsymbol{j}m$), to replace the terms E and $\mathbf{p}$ by the operators $E \rightarrow i\partial/\partial t$, $\mathbf{p} \rightarrow -i\nabla$ (equating $\hbar$ to 1 by convention), and assume that the operators act on the phase factor for a free fermion, $e^{-i(Et - \mathbf{p}.\mathbf{r})}$, we obtain the nilpotent Dirac equation for a free fermion:

$$\left(\mp ik\frac{\partial}{\partial t}\mp i\nabla + jm\right)(\pm ikE \pm i\mathbf{p} + jm)e^{-i(Et-\mathbf{p}.\mathbf{r})} = 0\,.$$

We can generalise this by adding potentials of any form to the operators. The phase factors will now take on more complicated forms, but they will be restricted to ones which produce nilpotent amplitudes, of the general form ($ikE + i\mathbf{p} + jm$), defined by the three algebraic operators ik, i, j, applied to coefficients defined outside the algebra. As a fermion responds to its environment by being acted on by various potentials, it reconstructs its phase or space and time variation, so that its amplitude remains nilpotent [6-10].

The special nature of ($ikE + i\mathbf{p} + jm$) with regard to self-organization becomes evident from taking reality as a zero totality. If we imagine an object with an amplitude ($ikE + i\mathbf{p} + jm$). That is a fermion, as being 'created' from nothing, then what is left, which in physics we describe as 'vacuum' or the rest of the universe, must be a kind of mirror image, $-(ikE + i\mathbf{p} + jm)$, which cancels it. And not only do these quantities add to nothing. They also combine (in the quantum mechanical sense of probabilities) to nothing, because

$$-(ikE + i\mathbf{p} + jm)\,(ikE + i\mathbf{p} + jm) = 0,$$

which means that we have immediate Pauli exclusion of all fermionic states.

A nilpotent operator effectively splits the universe into two halves, a local part represented by the fermion, and a dual, nonlocal, vacuum part, which incorporates the rest of the universe. If we 'create' a fermion in a particular state, specified by its interacting potentials, we then have to construct the vacuum or 'rest of the universe' which enables the fermion to exist in that state. This also means that we have, in the ultimate point-particle, a perfect expression of self-organization, for every fermion acts in such a way that the entire 'rest of the universe' to which it responds is always structured to be its mirror image. So we have here a system whose nature changes automatically by negotiation with its entire environment, and, because energy is conserved only over the entire universe, it is also an open dissipative system responding to the known laws of thermodynamics.

4 Isonilpotents

Point-particles may be fundamental to physics, but they are not necessarily the most convenient way of describing natural systems, which operate on many different scales. However, the universality of the rewrite structure we have proposed, based on a succession of zero totalities, suggests that similar conditions as for point-particles may occur at higher scales of organization. The isomathematics of Santilli [11], when applied to physics, is concerned with typically extended sources, for example involving media, etc., where conventional quantum mechanics and special relativity no longer hold, and where technological applications become important. The single-point version is also really the extreme of the range of options separating a self-organizing system from the rest of the universe. In principle, according to the rewrite structure from which it was developed, the same process should repeat at successive levels of organization. There seems to be evidence that it applies in chemistry and biology as well as physics. This means that it should be possible to develop a nilpotent version of an extended system using isomathematics.

The point concept in nilpotency is a point *charge*, not a localisation in space. The localisation occurs only in a *dual* space, which necessarily creates a wavefunction which is not localised. The connection between isomathematics and nilpotency is made through duality because both paradigms require equal amounts of matter and antimatter, positive and negative energy, two directions of time, etc., and further connections can be made with the twin universe theory of Leong Ying. Isomathematics creates the duality by reformulating mathematics [12-13]. Nilpotency creates the duality by using a mathematical structure defined by a rewrite process that becomes equivalent to introducing a dual vector space. Santilli reformulated mathematics by defining a new *isoproduct*:

$$AB \rightarrow A \otimes B = AT^*B$$
$$[A, B] \rightarrow [A, B]^* = A \otimes B - B \otimes A = AT^*B - BT^*A$$

This requires a new unit

$$I^* \otimes A = A \otimes I^* = A$$
$$I^* = 1 / T^*$$

The *isotopic element* T^* or $\hat{T}$ is defined very generally > 0. It is not a fixed value and may be a function of many possible variable parameters. The

mathematical structure carries over into physics, defined by algebraic relations. It allows, in particular, for the more complicated states in interiors of extended objects and in anisotropic media. The time evolution of a system, which conventionally requires the application of the exponential e^{iHt}, where H is the Hamiltonian and t is time, now requires the more generalised form, $e^{iHT^{*}t}$.

For example, we can redefine Minkowski space-time using a new symmetry, Lorentz-Poincaré-Santilli (LPS) isosymmetry

$$\hat{x}^2 = x^\mu g^{\mu\nu} x^\nu = x^\mu \hat{T}^\rho_\mu \eta_{\rho\nu} x^\nu ,$$

which, in effect, becomes:

$$\hat{x}^2 = \frac{x_1^2}{n_1^2} + \frac{x_2^2}{n_2^2} + \frac{x_3^2}{n_3^2} - \frac{c^2 t^2}{n_4^2}$$

The n values (> 0) are the variables required for an anisotropic medium (the characteristic qualities of the medium), for example in the interior of an extended body; c / n_4 will be a local speed of light, c < or > c. So, the maximum possible speed is no longer c, as in special relativity. Santilli's theory also requires a new mass-energy relation or isoequivalence law:

$$\hat{E} = \hat{m}c^2 = m_s \frac{n_s^2}{n_4^2} .$$

Since the nilpotent structure is defined only by its algebraic operators and not by whether the coefficients are fixed or variable, we can derive an isonilpotent form for the space-time of an extended structure, using Santilli's n coefficients:

$$\left(\pm \boldsymbol{ik} \frac{ct}{n_4} \pm \boldsymbol{ii} \frac{x_1}{n_1} \pm \boldsymbol{ij} \frac{x_2}{n_2} \pm \boldsymbol{ik} \frac{x_3}{n_3} + \boldsymbol{j}\hat{x} \right) \left(\pm \boldsymbol{ik} \frac{ct}{n_4} \pm \boldsymbol{ii} \frac{x_1}{n_1} \pm \boldsymbol{ij} \frac{x_2}{n_2} \pm \boldsymbol{ik} \frac{x_3}{n_3} + \boldsymbol{j}\hat{x} \right) = 0 .$$

The fermionic isonilpotent becomes

$$\left(\pm ikE \pm \mathbf{i}\mathbf{i}p_1 \frac{c}{n_1} \pm \mathbf{i}\mathbf{j}p_2 \frac{c}{n_2} \pm \mathbf{i}\mathbf{k}p_3 \frac{c}{n_3} + jm\frac{c^2}{n_4^2}\right)^2 = 0$$

with a corresponding isonilpotent operator

$$\left(\mp k\frac{\partial}{\partial t} \mp i\mathbf{i}\frac{c}{n_1}\frac{\partial}{\partial x} \mp i\mathbf{i}\mathbf{j}\frac{c}{n_2}\frac{\partial}{\partial y} \mp i\mathbf{i}\mathbf{k}\frac{c}{n_3}\frac{\partial}{\partial z} + jm\frac{c^2}{n_4^2}\right).$$

The expressions automatically include + and – E, matter and antimatter, two directions of time, matter and vacuum, etc., as required, and there is an opportunity to exploit iso-, geno- and hyper- extensions of nilpotent theory, in which the algebraic operator structure and nilpotent character remain while the coefficients (including the differentials) take on extended aspects.

In nilpotent quantum mechanics and quantum field theory, the 'medium' (vacuum) is already part of the structure and formal aspects of this could be investigated. However, there is no need to restrict the isonilpotents to quantum mechanics or some extension of this. They have a significance in all areas where a dual space is significant, and in any circumstance in which a system becomes self-organizing, for this effectively means it has a unique relationship to its 'environment' (i.e. the rest of the universe). In effect, it becomes a pure description of process, which can apply at any level, as the universal rewrite structure from which it is derived would suggest.

5 Self-organization

Isonilpotency suggests that the principles that make nilpotency a powerful way of describing how a point-particle interacts with its entire environment to make it a classic example of self-organization can be applied also to the extended systems that we normally observe in Nature. In principle, it offers a model for the self-organization and self-assembly that are ubiquitous in natural systems at every level, and can be observed in mathematics, computational and systems theory, physics, chemistry, biology and ecology. Investigation of these seems to suggest that self-organization in Nature follows a route involving a dual-space nilpotent structure, which immediately connects any organized system with its environment in a completely definable way. The mathematics

of the process is exact and operates on every scale from the quantum level to galactic clusters, and involves both living and non-living structures [14-17].

Characteristic features that have been observed include: double 3-dimensionality (one manifest, one hidden); two vector spaces needed creating a 'singularity' as boundary; a double helical structure or double twist; a 5-fold broken symmetry (which results from combining two 3-dimensionalities) – and the consequent appearance of Fibonacci numbers and the golden section; uniqueness of the objects and unique birthordering, irreversibility and dissipation. We also usually observe a harmonic oscillator aspect to the structure; a tendency for aggregation (Van der Waals forces, etc.); single-handedness (chirality); and a characteristic appearance of key numbers, including those relevant to Platonic solids (with their dual spaces) and groups like E_8 [18-21].

Self-organization of this kind appears to have been observed in solid state matter. Coldea et al have observed that linked chains of magnetic atoms of cobalt, one atom wide, transform, when a magnetic field is applied at right angles to an aligned spin into a quantum critical state. This is a quantum version of a fractal pattern, with resonances occurring in the golden ratio of 1.618..., and reflecting an underlying E_8 symmetry [22].

Self-organization is, of course, ubiquitous in biology, which is entirely concerned with self-organizing systems interacting with environments. Replication, using the processes of transcription and translation, provides a classic example of a system interacting with a mirror image environment, with a 'hidden' 3-D structure determining the behaviour of the one we observe. Application of exactly the same 64-part algebra used in the Dirac algebra to the genetic code suggests that it follows a similar pattern to the self-organizing of the fermion and vacuum in quantum mechanics.

The human brain may well function in a way that can be modelled using the same overall pattern. Giuseppe Vitiello, who has stressed the need to describe the brain thermodynamically as a dissipative system, has proposed a quantum field model based on positive energy output by the brain mirroring negative energy output by the environment, exactly as is found in the nilpotent description [23].

In physical systems, the nilpotent structure ($\boldsymbol{ikE} + \boldsymbol{i}\mathbf{p} + \boldsymbol{jm}$) can be seen as an expression of conservation of angular momentum, either of the system or of the system plus environment. Large-scale systems, such as galaxies, acting as a

collective unit under gravity, clearly conserve angular momentum in this way, and this can be modelled by expressions such as ($\boldsymbol{ikE} + \boldsymbol{i}\mathbf{p} + \boldsymbol{jm}$). Morris et al have actually discovered a helix-shaped nebula near the centre of the Milky Way, which extends across 80 light years, but looks like the typical image of a DNA molecule. The massive object at the centre of the galaxy has a magnetic field powerful enough to force the gas cloud to twist along its field lines [24].

As Tsytovich et al have also demonstrated, particles in a plasma can undergo self-organization as electronic charges become separated and the plasma becomes polarized [25]. The result is the formation of microscopic strands of solid particles twisting into corkscrew shapes, another helical structures resembling DNA. These strands themselves are electronically charged and attract to each other. They can split to form two copies of the original structure in a kind of replication and can also interact to induce changes in their neighbours. They can even evolve into further structures as less stable ones break down, with only the 'fittest' structures surviving in the plasma.

Large-scale, and many other, systems are also thought to respond to the holographic principle [26, 27], according to which the entire information about a system is encoded in the bounding area, either as distance × distance or distance × time. In the nilpotent structure, this is equivalent to the combined terms $\boldsymbol{ikE}$ and $\boldsymbol{i}\mathbf{p}$, as the $\boldsymbol{jm}$ term is an automatic consequence of squaring to zero. E and $\mathbf{p}$ here form the equivalent of a time and a single dimension, and so code the entire information about the system in the equivalent of a bounding area. The related concept of quantum holography has now been unequivocally demonstrated in the case of 'quantum holographic encoding in a two-dimensional electron gas' [28]. In quantum holographic terms, the nilpotent structure naturally accommodates phase ($\boldsymbol{ikE}$), amplitude ($\boldsymbol{i}\mathbf{p}$) and reference phase ($\boldsymbol{jm}$). Again, it is possible to reconstruct the entire structure with knowledge of just two terms, say, phase and reference phase. Quantum holography differs from classical holography in being nondegenerate, and we may invoke the uniqueness of the nilpotent condition for the fermion as being the source of this uniqueness. Only one universal condition is possible at any instant, and it can be described by a unique birthordering among fermionic states described by nilpotent operators.

6 Conclusion

Isonilpotency offers immediate evidence that the generalised nilpotent condition, derived from relativistic quantum mechanics, can be applied to all natural self-organizing systems, which are necessarily extended and so do not fulfil the conditions required for the application of conventional quantum mechanics and special relativity. The derivation of the nilpotent structure and nilpotent quantum mechanics from a universal rewrite system with a fractal structure and seemingly infinite extension suggests that the same patterns will be applicable in systems at many levels. Sustainable development requires understanding, among other things, of the spontaneous behaviour of natural systems, especially in terms of self-organization and self-assembly, and the nilpotent formalism, with its isonilpotent extension, suggest that a mathematical structure exists that can be applied generally to develop an understanding of such systems. In this paper, we have shown how the abstract mathematical process operates and described how it provides the natural explanation of self-organization at all scales, in addition to supplying examples of its application.

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GEOMETRIC LIE ALGEBRA TRANSFORMATIONS OF ELEMENTARY PARTICLES WITH LINEAR INCUBATION OF THE PERIODIC SYSTEM

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Abstract

Sophus Lie discovered a "particularly remarkable transformation", whereby "main tangential curves can be brought back to...rounded curves" in an infinitesimal trigonometric "limit transition" by a resulting perfect "polygon projection"... "into the sphere's rectilinear generatrices" of the "space's straight lines of length equal to zero." These are the eigenvectors of physical extension and the ground element also of Hermann Grassmann's *lineale Ausdehnungslehre,* later known as Clifford or geometric algebra. United as geometric Lie algebra, a modern nanotechnology structural replication/falsification is a hexagonally symmetric isotropic vector matrix (IVM) of octahedrons and tetrahedrons juxtaposed to the orthogonal spatial framework which provides a cyclically self-similar material constitution from the bottom up in real three-dimensional space, where SU(3) and SU(2) × U(1) Lie transformations and geometrical algebras of the respective tri-vector baryons and bi-vector mesons replicate all hadron states while the U(1) lepton and nuclear resonance events with formation of atoms and the periodic table and onwards according to the structuralist tenets of Mendeleev's era are outlined by the geodetic sequences and cross-sections of the IVM mono-vector eigen-elements of the scientifically solid and in every detail verifiable realization.

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Introduction

When the English translation of Marius Sophus Lie's Norwegian Doctoral Dissertation *Over en Classe geometriske Transformationer* from 1871[1] now becomes internet open accessible[2], it will be widely recognized that his discovery how "through a particularly remarkable transformation...main tangential curves can be brought back to...rounded curves" stands in "intimate dependence on philosophical reflections upon the nature of Cartesian Geometry",[1,2] This "equated the defining property, or 'essence', of material substance with three-dimensional spatial extension: 'the extension in length, width, and depth which constitutes the space occupied by a body, is exactly the same as that which constitutes the body...consequently, there cannot exist a space separate from body, since all spatial extension simply is body'".[3] Adopting this view, Lie opened up the till then mathematical terra incognito where "as element for the geometry of the space can be used any curve that is dependent on three parameters"[1,2], and where more specifically "Plücker's monumental idea to create new geometries by choosing figures other than points – in fact straight lines – as elements of space pervaded all of Lie's work".[4]

It may therefore seem paradoxical that his thesis sets out to examine "an - as it appears to me - fundamental relation between the Plücker line geometry and a spatial geometry whose element is the sphere"[1,2]. However, "Cartesian geometry, namely, translates any geometric theorem into an algebraic one and thus of the geometry of the...space a representation of the algebra of three variable quantities" so the way in which the "Plücker line geometry can be transformed into a sphere geometry" is by "transforming space r's straight lines into space R's...spheres' rectilinear generatrices" (= infinitesimal generators in today's terminology), where "x,y,z are perceived as parameters and...dx,dy,dz as direction cosines" and "the equations that map the two spaces into each other are linear in relation to any system variables" and "by geodetic curves of length equalling zero...transform two spaces into each other." Lie recognized that he had thereby found "a new geometric representation of partial differential equations of the first order" but the main "idea is thus...to show that a straight line in r transforms as an unambiguously determined sphere in R" because "to a surface F's rounded curves given in R correspond in r line-surfaces which touch the image-surface f along maintangent-curves and the surface f's tangents transform into spheres that touch F".[Ib] But since in general "to r's points correspond in R

the imaginary straight lines whose length equal zero" there are also projections which "turn surfaces that touch each other into like surfaces...points into points, spheres into spheres and finally straight lines of length equal to zero into similar lines".[Ib.]

The blend of quotations above shows by the trigonometric, coordinate, differential equation, algebraic and other connotations the universal span and comprise of the dual "curve-net" or "ray-bundle" or "complex-cone"; in today's parlance linear vector space system he unveiled and continued to enrich and systematize in its vast expanse, e.g. in the monograph "*Classification der Flächen nach der Transformationsgruppe ihrer geodätischen Curven*" in 1879 and (together with Friedrich Engel) in the monumental work *Theorie der Transformationsgruppe* in 1888-1893. At this time, in 1889 Wilhelm Killing introduced his *Wurzelsystem*[5] to represent over the complex numbers Lie's continuous transformation groups and their associated algebras (which were then referred to as algebra of infinitesimal transformations of a Lie group; the assignation *Groupes de Lie*, was given in 1893 by Arthur Tresse and *Lie algebra* in 1934 by Herman Weyl). Lie himself besides continuous transformations used the term infinitesimal transformations for both group and algebra generators and operations and that illuminates the tautology that exist between them like in a maze of mirrors. The algebra is acting on the group and to every Lie group a Lie algebra can be associated whose underlying vector space is the tangent space of the Lie group at the identity element and which completely captures the local structure of the group. We are back to the outset "infinitesimally close" to the identity where the elements of the Lie algebra are also the generators of the Lie algebra and simultaneously elements of the group and the mutual derivation-integration commutation relation between them has the same root space diagram since thus the "mapping contains a neighborhood of the identity".[6]

Therefore, the Killing root space diagrams not only represent but embody both the respective group and its algebra at their identity and can be regarded and studied as geometrical patterns and structures by their own virtue, including in direct nanotechnology capacity as concrete infinitesimal lattice modules in the self-similar and self-assembling physical objects and transactions they hybridize as part of the isomorphic operational alternatives they can carry. For instance, Lie himself found that his "linear transformations of r" could hold a variety of projections between spaces; "If now the one of the two spaces is subjected to an, e.g., transformation by which surfaces that touch each other, are turned into similar surfaces, the corresponding transformation of the other space will possess

the same property". As examples he mentioned, "*in that we restrict ourselves to linear transformation of r, we find between the corresponding transformation of R: all movements (translation movement, rotation-movement and the helicoidal movement), semblability transformation, transformation by reciprocal radii, parallel transformation...etc*".[1,2]

So when here in their established qualification as maps of the elementary particle symmetries and interactions, SU(3) and its subgroups/algebras will be studied, it will be - in no conflict whatsoever with any other faithful, e.g. matrix representation - by their respective root diagrams as a direct physical vector field in real space. To quote Lie again; "When none-the-less no one, as far as I know, has realized this thought, the ground must probably be sought in that no advantage that might result from this was seen." But now the advent and advancement of Nanotechnology down to the scale of the atoms and below, always encountering the same self-similar modular crystallization build of matter, makes this final step down to the identity threshold a useful, both immanent and imminent one, due to be taken.

Methods and results

The procedure is quite straightforward (Figure 1). Geometrically at the basic level SU(3) describes the internal rotations and equivalent *translation movement...helicoidal movement, semblability transformation, transformation by reciprocal radii etc*[1,2], of an object, e.g. quark or, like here, an "infinitesimal sphere"[1b], which in turn is concluded to be the "preferred ground state of the

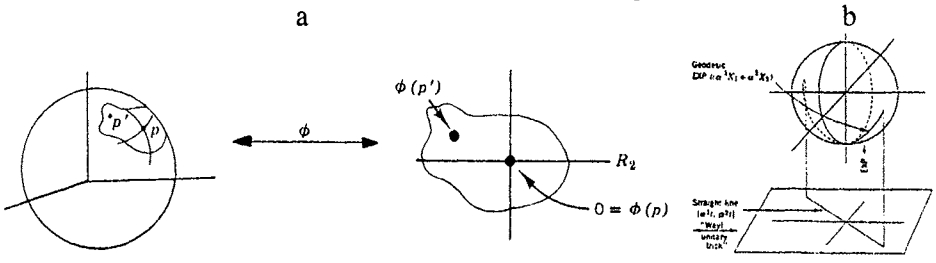

FIGURE 1: (after Gilmore[7]) a) The mapping ϕ maps a neighborhood of an infinitesimal point or b) line element, i.e., a "straight line whose length equals zero" and its r_n coordinate axes onto (or into) a neighborhood (i.e. the smallest region in which they are fully contained) of the origin of R_n.

system" of hadrons, e.g. in the MIT Bag model.[8] Of the said projections, in which "when a point runs through a line of this linear complex, the corresponding straight line in R describes an infinitesimal sphere"[1,2], a combination is applicable because it outlines the unit gauge- and spheroidal symmetry-preserving actual spectroscopy of the observed elementary particle interactions under the group operation of how changes over and between the straight root vectors of the sphere's infinitesimal generator are mapped onto the Euclidean/Plücker space's coordinate axes according to the principles shown in two dimensions in the figure.

In effect, "the mapping contains a neighborhood of the identity"[6] meaning that there is no distance between the moieties but both are equally infinitesimally close to and therefore share the coordinate centre. When transferring this "connection between the metric and projective properties of space"[1,2] from two dimensions to the real three dimensions there is an expansion of the hybridized root space diagram which corresponds to the orthogonal coset decomposition of SU(3).[9-12] The Euclidean/Plücker part is generated by all three ordinary space coordinate axes, outlining (Figure 2a-c) a central 2^3 neighborhood of eight cubical

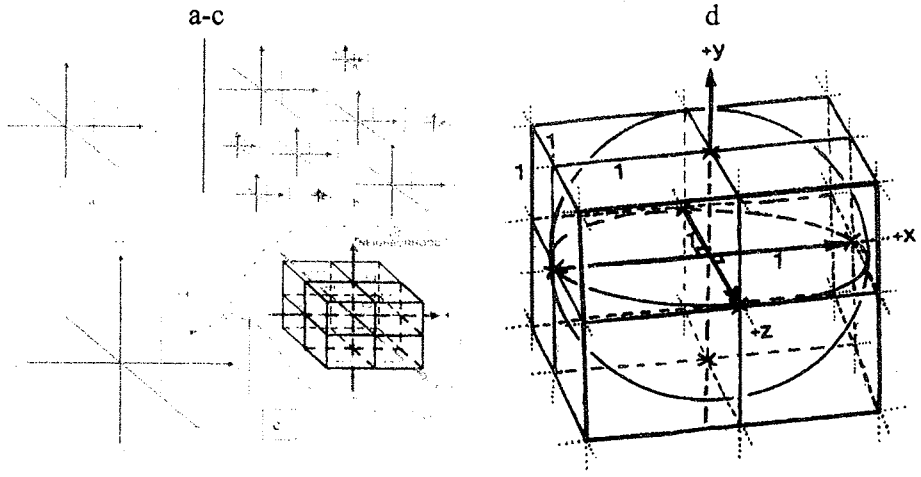

FIGURE 2: a) The Cartesian coordinate system spans 3-dim Euclidean space in eight cubical segments. What is the constitution of a local part (?) in any of them? b) Regardless of size it retains Cartesian representation. c) Hence, smallest space portion at limit scale of "straight lines of length equal to zero" is the infinitesimal Lie neighborhood of eight indivisible ground unit cubicles or CuBits. d) Hybridization of unit "infinitesimal sphere" in the Lie neighborhood incubator.

Cartesian segments, which form a veritable incubator (Figure 2d) into and onto it since both the origin and the first step from there of them are entirely within the neighborhood then to continue by iteration. It is seen that each 'cuBit' contains 2+2+2 hyperplanes (Figure 2 d).

Merging the sphere's infinitesimal generator vectors in the mutual neighborhood involves expanding their A_2 root diagram from two dimensions over the complex space to three over the real by duplication (Figure 3). The angles between themselves are 60/120°. The transformation group operation ϕ in this structural replication of SU(3) direct in its "canonical involutive automorhism"[9-12] root space lattice is the mapping of the sphere's infinitesimal generator A_2 diagram unit axes (customarily referred to as t isospin vectors) and their sequences onto the Lie neighborhood's Euclidean space hyperplanes upon which they manifest.

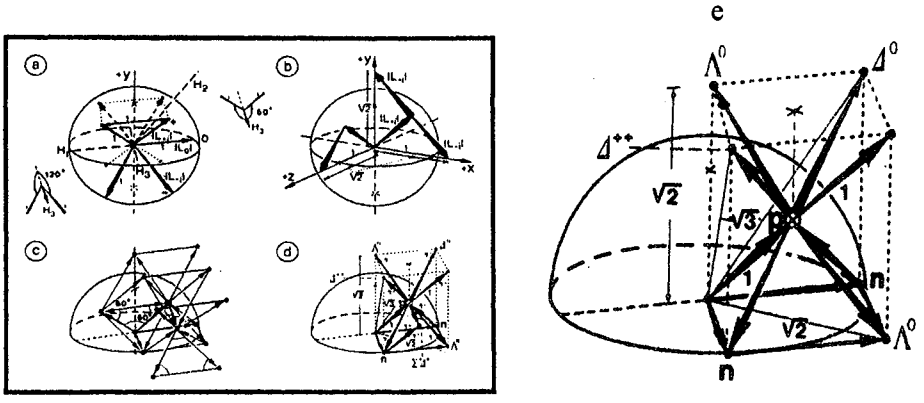

FIGURE 3: a) Spherical root vector space spanned by duplicated A_2 diagram whose neutral isospin vectors coincide with Cartesian X and Z axes but whose b) charged t isospin axes c,d) set up a lattice with unit side continuing in the surrounding as space-filling regular tetra- and octahedrons. e) Projection of t isospin root vectors and their first steps onto the real space's horizontal and vertical planes with length $2^{½}$ and $3^{½}$ respectively.

In reality ϕ [7] is thus more than a mapping but the infinitesimal "translation movement"[1,2] of an elementary particle's t isospin root vector, necessarily in unit steps of itself, as physically taking place and recorded in the Euclidean space.

Figure 3 b and e show the two closest outcomes, triggered e.g. by a corresponding collision or scattering experiment impact, and in the prevailing condition of symmetry- and volume-preserving transformations of the unit sphere giving rise to ellipsoidal major semiaxes of length $2^{1/2}$ and $3^{1/2}$, respectively, which exactly match the Λ[10,13] and Δ baryons[9], also in terms of the channels (Figure 3 e) and electromagnetic charge level as assigned by the direction of the applied root vector. As reproduced here in the ground states from the first report in 1983[13], the transformed states at lowest energy appear as symmetric ellipsoids. The mass expression is inversely proportional to the unit radius of the proton ground state by the formula 1/minor semiaxis × 938.27 Mev according to the quark pressure formula, $\Delta p = \hbar/\Delta x$[9,19,22-27], as well as, equivalently, directly proportional to the surface cross-section area by the Higg's mechanism.[12,14,15]

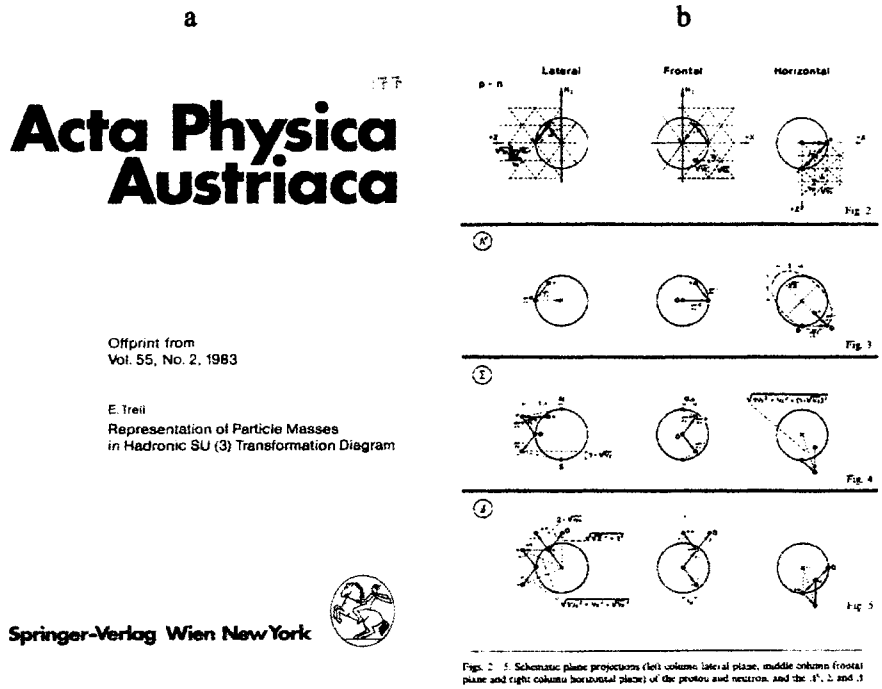

FIGURE 4: a) Cover of *Hadronic SU(3) Transformation Diagram* report of ground eightfold way baryon supermultiplets and the Λ series with b) plane graph of the p-n, Λ^0, $\Sigma^{+,-}$ and $\Delta^{++,+,0,-}$ states.

As seen, parent transformations may occur also by projection against the Euclidean hyperplane "touching"[1,2] the sphere's poles (the Σ baryon[10]) or, like the Ξ resonance from Λ, emerging from the focal point of second-generation states.[13] The major semiaxis end-point of the transformation is the termination of the *t* isospin sequence virtually landing upon the hyperplane there and thus setting up a new node, around which the hyperplane lattice continues in a recurring order so that from every ground state a corridor opens for a series of consecutive further resonances just like in reality, too, including the angular momentum corresponding to the levels out from the origin the state appears.

Since reported at depth in the respective papers, and surveyed in the now internet accessible special issue of Hadronic Journal dedicated to Marius Sophus Lie[2], no further specification is made here. However, in Figure 5 a system chart of the basic baryon supermultiplets states[12] shows their distribution and outlines according to their group chains both in the geometrical model and reality. It is seen that the symmetry- and volume-preserving ellipsoids form a regular and aesthetically pleasing string-of-pearl set of beads harmonized (and tinged) by the quintessential transformation principles.

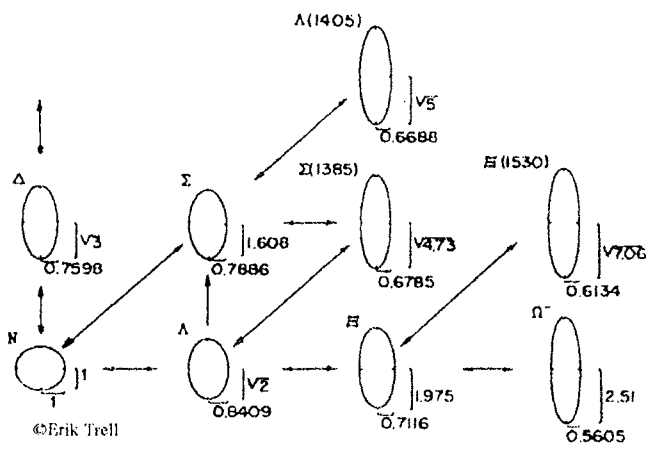

FIGURE 5: 'Eightfold eightfold' way distribution, channels and semiaxis lengths of basic baryon supermultiplets.

Otherwise, the further baryon resonance series and the mesons including the *charm* and *bottom* varieties in both[12,14-18] have thus been described in detail before and will be occasionally recapitulated only in their relation to the SU(1) lepton and nucleon spectroscopy. To that end there is a complementary algebraic representation which beyond the events attends to the elements that undergo them. This is Hermann Günther Grasssmann's "*lineale Ausdehnungslehre*"[19], later known as Clifford algebra[20] or Geometric algebra.[21] Like Lie algebra, and here combined with it as geometric Lie algebra, it also deals with the "straight line of length equal to zero"[1,2], but more from the complementary angle what this unit equally theoretically as practically forms and builds in participatory exchange with everything else in the world including our directly interacting organisms.

Such merge of abstract and concrete, of mathematics and matter, under a common, simplest possible, further irreducible bottomline formative element and principle is in effect the aboriginal conception since prehistoric times, and the same applies to the ways and means of constructions and assemblies of the basic building bit and its self-similar expansions and combinations. That in effect in real space the straight line spans three dimensions but cannot reach further was first deduced by Ptolemy (Figure 6), who in his book *On Distance* (150 AC) wrote: "Draw three mutually perpendicular lines. Try to draw another line perpendicular to all of these lines. It is impossible. The fourth perpendicular line is entirely without measure".[11,14,15]

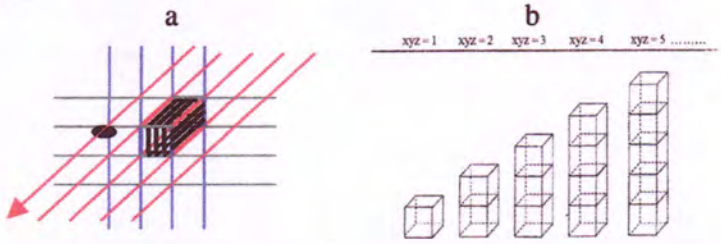

FIGURE 6: a) Ptolemy's crisscrossing of three-dimensional real space generating its 'cuBit' infinitesimal eigenelement as well as Reality's ground geometric algebra trivector. b) Three-dimensional Diophantine whole-number cells, one-dimensionally joined as digits to infinite series of integers of the first degree by the same discrete amount of the ground unit cubicle, or 'cuBit'©. They are both mathematical and geometrical units, forming whole-numbers as well as Euclidean space compartments in direct crystallographic aggregation.

The same observations on the "*Nothwendigkeit der drei Dimensionen* * *des Raumes*" in "*reales...Sein*", and that in "*der ganze unendliche Raum...weiter als bis zu drei unabhängigen Richtungen (Aenderungsgesetzen) kan mann hier nicht kommen, während sich in der reinen Ausdehnungslehre die Anzahl derselben bis ins Unendliche steigern kann*" were made also by the inventor of linear algebra, Hermann Günther Grassmann[19], who already in 1844 in his "*lineale Ausdehnungslehre*" returned to and revived "the fundamental geometrical roots of all algebra....in the form of spatial operations of spatial structures"[20] as then further developed by William Kingdom Clifford and perfected as *Geometric Algebra* by David Hestenes.[21]

The seeming paradox is how the innermost infinitesimal constitution comes about in physical space – which is infinite. For Cartesius it is the unending straight line that as the eigenvector of extension is the singular antithesis of non-existence, and even Grassmann submits to that "*in der Raumlehre...entspricht... die gerade Linie dem ganzen System*".[19] But as Ptolemy showed it is the essential three-dimensionality of extension that resolves the dilemma by the collective universal crisscross of its straight line eigenvectors impending in their cohabitation (Figure 6a), and which yields the smallest 'cuBit' trivector ground element and numerical unit for the real space geometrical algebra and arithmetic thus come true (Figure 6b).

Albeit now forgotten, this is an original conception and practice, and no after-rationalization. Even "the geometry Euclid learnt from his Ionian teachers...was originally based on watching how people built"[22], and "the measurements of volume by the number of cubes with sides of standard length required to fill a solid space was probably first used by the Sumerians who built with bricks".[Ib.] The most important of such ordered compartmentalization of the endless cubical space matrix was to the Diophantine equations, on which he himself "stated the traditional definition of numbers to be a collection of units...simply put down without the use of a symbol".[23,24]

It is possible to make a reconstruction of a virtual space abacus that can be used for the stepwise compilation of the entire Diophantine equation universe[11,15] in a simple, yet realistic and, as classical tessellation, quite mathematical way and possible to lay out in a continuous, non-overcrossing order in cyclically expanding 'rod-square-cube' cycles that unite recent nanotechnology crystallization practices with ancient architecture and thereby the originally

* *For exactness, the Grassmann quotes are reproduced in their original German formulation*

conceived Euclidean space (Figure 7). Its reality-conformed innovation is that its ground 'cuBit' spatial and numerical unit already is a geometrical algebra tri-vector with mathematical as well as spatial faculty and disposition and acting

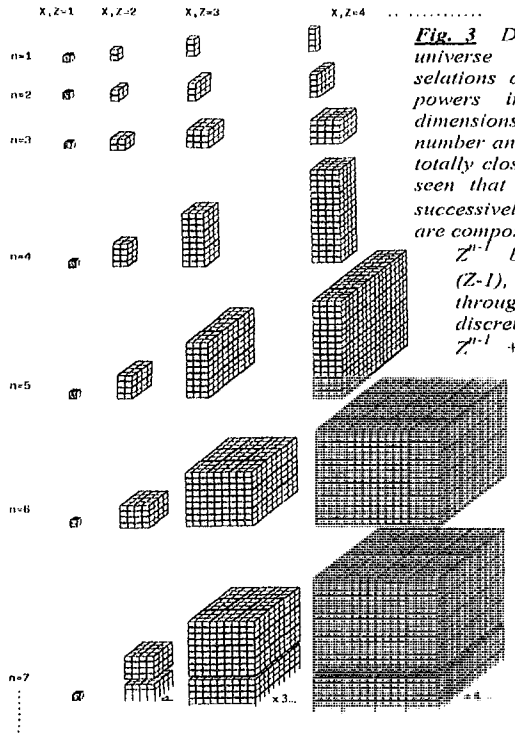

Fig. 3 Diophantine equation universe of consecutive tesselations of all whole-number powers in maximum three dimensions, endless along both number and exponent axes and totally closed from n = 3. It is seen that in all columns all successively expanded Z^n terms are composed by the preceding Z^{n-1} block plus one less, (Z-1), Z^{n-1} block, that is, throughout the whole discrete infinite field: $Z^{n-1} + (Z-1)Z^{n-1} = Z^n$ ($= Z^n + (Z-1)Z^n = Z^{n+1}$). It is also seen that not only all Z^n sums but also, one power level lower, all X^n:s and Y^n:s are embodied in the fully extrapolated map.

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FIGURE 7: Diophantine equation universe of consecutive tessellations of all whole-number powers in maximally three dimensions, endless along number and exponent axes and closed from n = 3. The formula $X^n + (X-1)X^n = X^{n+1}$ is both universal and unique since (apart from X=3) only (X^1-1) may be of n.th power and (X-2,3,4...) is too small to raise the sum to next power. Each n row exhausts the respective n power in an equivalent sequence so that when a difference between two members in a row would be of nth power this would happen correspondingly translated in all other rows and since it is proved that it cannot happen in the n=3 row, it cannot happen in the others either. This is a "lazy proof" of Fermat's Last Theorem (FLT) as well as, reciprocally, Beal's Conjecture.

both within itself and transferred to higher powers by equal algorithm, which is essentially that of Grassmann's original *Ausdehnungslehre* whose "*verschiedenen Elemente* and *veränderliche Grösse*" find as "*deren konkreter Darstellung, der Linie*," whether this is "*extensiv*", that is, as a chain whose *"Elemente wesentlich auseinander treten und dadurch eben die Linie als Ausdehnung konstituiren"*, or "*intensiv*", that is, when "*man von der Art, wie ihre Elemente aus einander sind, absieht, und blos die Quantität der Elemente auffasst"*.[19] In the next stage "*werden bei zwei verschieden Richtungen"* of the line "*einer Ebene erzeugt"*, i.e., in modern terminology a bivector[Ib.,20,21], and "*nimmt man eine dritte unabhängige Richtung hinzu"*[19], a trivector results which in the general case is the unit cube[20], i.e., the CuBit. This fills the three dimensions of real space and *"weiter...kan mann hier nicht kommen während sich in der reinen Ausdehnungslehre die Anzahl derselben bis ins Unendliche steigern kann*"[19] by the cyclical iteration of the 'rod-square-cube' sequence of each digit (Figure 7).

Thereby "the hierarchy of Clifford Algebras, each with its own characteristic pattern of components, that appear in numbers corresponding to Pascal's triangle"[20] is directly realized (Figure 8) and can be used arithmetically,

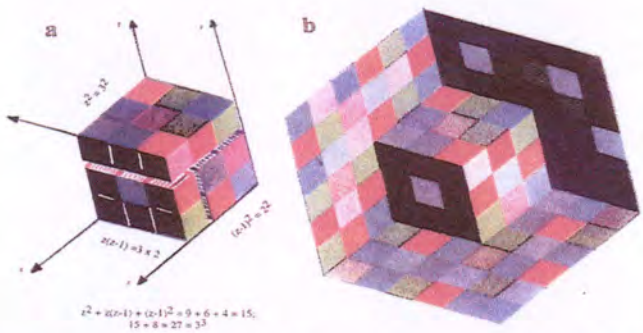


FIGURE 8: Stepwise coating of Z^3, illustrated by an adaptation of a painting by Victor Vasarely, which shows a) by an extract and dissection of 3^3 its growth by a 3^2 roof plus a 3×2 front plus a 2^2 side according to infinitely ascending $Z^2+Z(Z-1)+(Z-1)^2$ and by $Z^{n-1}+Z^{n-2}(Z-1)+Z^{n-3}(Z-1)^2+...Z^2(Z-1)^{n-3}+Z(Z-1)^{n-2}+(Z-1)^{n-1}$ expanding difference formula. b) When number of layers in mantle between X^n and Z^n are included, the FLT equation and proof in all dimensions are solved by binomial expansion of the cubical proof.

e.g., to prove FLT (and BC) in summative (Figure 7)[11,14,15] or multiplicative[25] power series analysis (Figure 8). The only alteration made to the original visionary geometrical art painting by Victor Vasarely was to dissect the here assigned lid, front- and side-wall off the (likewise Hungarian) Rubik cube-like 3^3 excerpt to the left in the painting (Figure 8).

Thereby an ascending differential formula is unveiled which goes to infinity through all powers just back and forth in successive steps along the Cartesian x, y and z axes. In application to FLT and BC the ascending differential equation takes the form of the binomial expansion with identical solutions in all powers so that the proof for n = 3 also covers every higher degree.[4,15,25] The continuous filling of space by 'cuBit' ground space-number "three-dimensional clifs...isomorphic to Pauli matrices used to model subatomic particles" in succession breaks the three-dimensional barrier into the abstract higher degrees in an infinite ascending cyclical inflation with number of vector elements and equation terms in each dimension precisely "corresponding to Pascal's triangle".[20,25]

Coming back later to a number of other cumulative processes crystallizing along the inherent both serial and convoluting alignment of their field, the local properties of the elements and their agglomerations will first be briefly considered as primarily originating in the infinitesimal cuBit ground unit, which, in a histological analogy, is the virtual undifferentiated stem cell of the entire system. How is it transformed and the transformations agglomerated to specialized tissue self-organization in the realized micro- and macrocosmos? This is where the Lie groups and algebras join the Clifford analysis[20], providing the missing link to accomplishment of the ultimate aims also of quantum chromodynamics and string theory as recently expressed, for instance, in the *loop quantum gravity* theory: "Humanity's (current Western, one might qualify) best attempts at the ultimate explanation of matter and energy, space and time...suffer from a fundamental weakness...the strings move in a spacetime whose shape has been chosen from the beginning, as if they were actors on a previously constructed stage. A truly fundamental theory...would build the stage itself...just as matter is made of atoms and elementary particles, space consists of tiny indivisible bits...with a recipe for transporting direction-indicating vectors through spacetime".[26]

Figure 3 displays the organization and mechanism of such an incubator set up by the straight line as sole element of micro- as well as macrocosm. At the same time it provides a practicable dummy for rational empirical research according to the objective scientific methods of exploration and falsification how the verifiable results of simulations in the hybrid lattice of the infinitesimal

generators of the sphere spliced with those of the cube in a mutual tangent relation tally with the recorded iterative and transformation processes in the observed world including the constant geodetic intervals and apparent absolute speed of light between successive steps of its propagation determined by that diametrical trigonometric differential inclination between them; and so executing a sufficiently three-dimensional reproduction "in the form of spatial operations"[20], interrelations and interactions of the mono-, bi- and trivector physical structures of an immediate 'geometrical Lie algebra' real universe. As seen from Figure 3e and in further sequence in Figure 9, the basic module of iterative trivector projections is generated by unit monovectors and their likesided Platonic triangular bivector planes from and outside of the proton and the paths that can be taken by the charged root vectors in their 60-120° sequences.

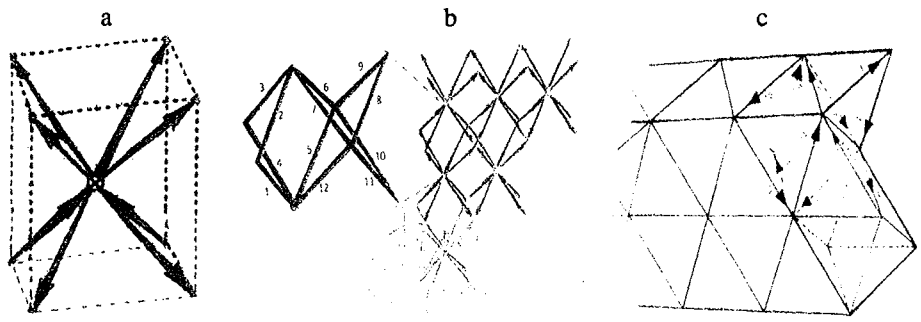


FIGURE 9: Part of lattice formed by the charged *t* isospin root vectors from center and outside of the nucleon. a) One spacefilling module of eight charged A_2 *t* isospin root vectors in one of the eight Cartesian segments around proton center. The modules commute with the Cartesian coordinate axes only at the equatorial plane; other intersections are missed by the height $2^{1/2}$ of the module. b) Sideways concatenation in a continuous cloverleaf path of the root vector steps, where moving backward over a positive vector gets negative sign and the modules meet pair-wise in a parallelepiped chain which enclose one octahedron and two mirror-reflected tetrahedrons into c) the only other than the cube space-filling regular solid unit convolution, consisting of equally many, but 60° slanted edges.

Since they don't commute with the central Cartesian coordinate system other than at the origin and upon the equatorial planes, they have to find circuits to come back to the identity and the only continuous way is by a spacefilling

octahedron-tetrahedron 12-step singlet which has to go into a wider route giving rise to a lattice of the only other spacefilling regular solid unit compound than the cube, namely, a complex of one octahedron and two tetrahedrons (Figures 9, 10).[11,14,15,27] Like the cube, it consists of 12 unit edges, however, all 60 degrees slanted in relation to the Cartesian coordinate references indicated by the horizontal lines in figure 8c. It is a coherent phase transition[11,12,14,15,27] forming an important nanotechnology structure, i.e., an ordinary space frame (Figure 10), alias octahedron-tetrahedron, or octet truss[28] whose modular building blocks and their assembly can thus be realized from the ground of material organization. Being instantly spanned as a simultaneous mapping all over the global field[Ib.], it will crystallize from multiple origins as an *ab initio* at once isotropically distributed infinite universal inflation.

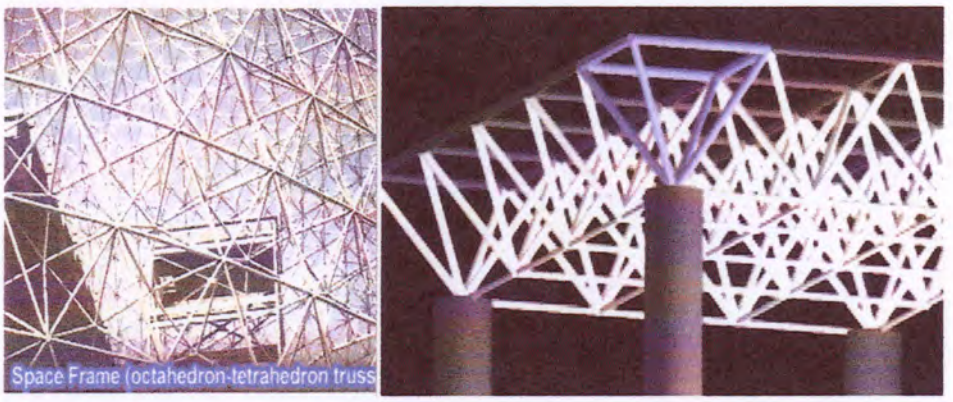


FIGURE 10: Two pictures of octahedron-tetrahedron truss space frame, in pure and strongest form composed of interlocking tetrahedral and octahedral crosspieces in which all the struts have unit length. More technically this is referred to as an isotropic vector matrix or in a single unit width an octet truss.

As illustrated in figure 9a, the individual space frame units spring from the Cartesian segments of the Lie neighborhood, moving out of the central unit sphere, which thus abides as a hub of the global realization. In relation to the octet truss cast this is most pertaining because, "viewed mathematically, as a generic pattern, its hubs correspond to the centers of spheres of equal radius".[Ib.] It is what Buckminster Fuller called "an isotropic vector matrix (IVM)...with everywhere-

the-same energy conditions" and "emphasized…over the more familiar *xyz* apparatus, arguing that our fixation on cubes and right angles goes against the grain of nature".[1b.]

In an isotropic vector matrix there are ample possibilities for coherent aggregations, with many physical, chemical, technical, architectural etc. build-ups and applications[1b] which without gaps combine with each other and in general. One space-filling motif that the 12-step complex of one octahedron and two tetrahedrons here identified as an electron 'singlet' coil may be directed into (Fig. 11a) is the truncated octahedron (Fig 11 b), which in the continuous plotting here in palindromic Bohr orbital model periods is seen to return 180° turned after 152 × 12 = 1824 unit steps to its IVM module hub (Fig. 11a). One singlet translation is then needed to get into the next lap, adding up to 1824 + 12 = 1836 step to start the ensuing period. This moves the hub one step so that for the 1836 steps of the module thus balances one step of the hub which allows a calculation of the respective inertia = 1/1836 (Fig 11b), which is precisely the electron/proton mass ratio.[9-16,29]

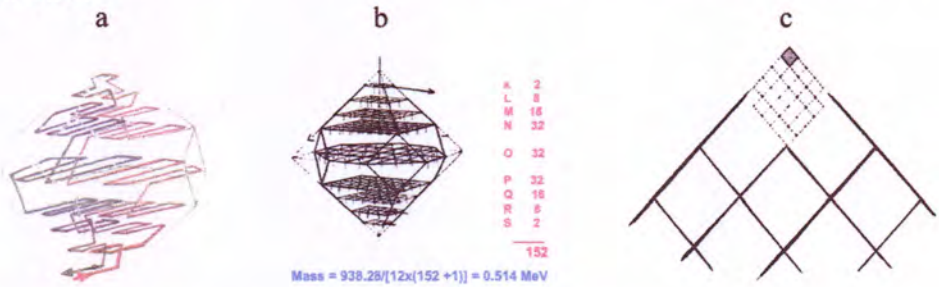


FIGURE 11: a) Continuous path of the 12-step electron singlet coils into b) space-filling truncated octahedron whose successive expansion to atomic size is shown by c) equatorial plane cross-section of first three self-templating cycles.

The contribution of the present findings is the bootstrap generation at the infinitesimal level by an irreducible digital realization faithful to the true Lie "reflections upon the nature of Cartesian geometry"[1,2] of the IVM lattice and its building elements and composition. Connected and coherent by the sharing and interlocking of its lattice sides, the crystallization is hence at once universally completed in a throughout origin-coordinated, literally worldwide web organization that is necessarily uniform in order to avoid internal collapse. In the

global expansion self-similarity provides the algorithm, by which the modules both template and fill out a successive cyclical expansion of their motif (Figure 11c). In that way, the ten-thousand times larger atom cross-section is reached within a limited amount of cycles.

Identifying the ground IVM modules here with the electrons/positrons may seem far-fetched but is in agreement with scientific observations of their two-fold cast as "wave functions or transition matrix elements"[30], and also with their actual weaving of our outward world and interactions. In that regard, and keeping to the practiced cubical 'art of stacking', the straightforward tessellation alternative is summarized in Figure 12. When investigating the nucleogenetic process as a

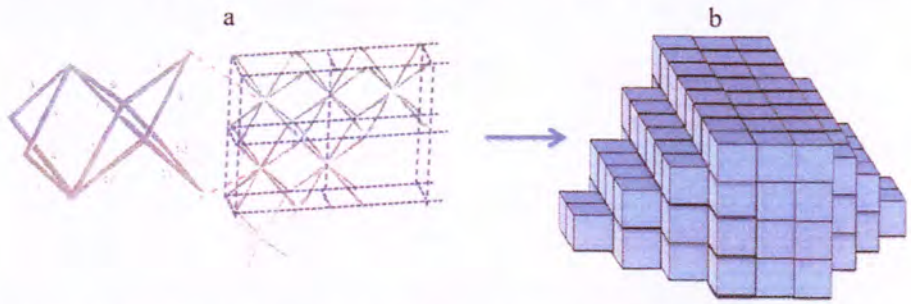
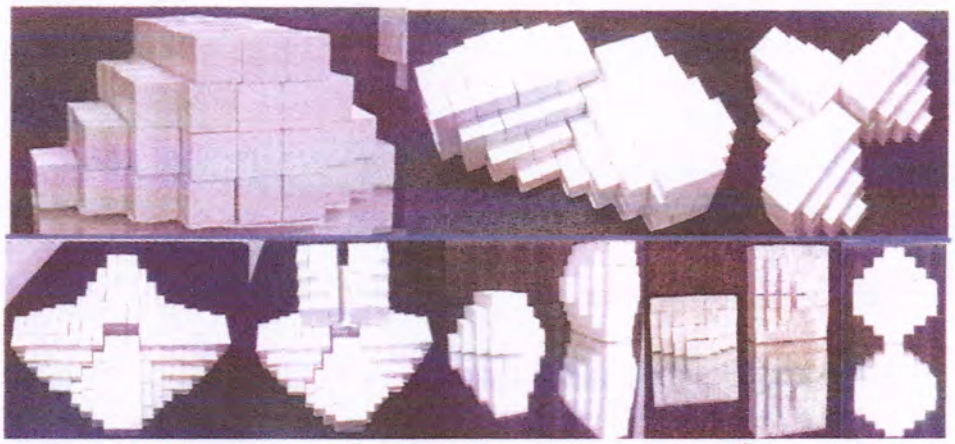


FIGURE 12: a) 12-step space frame lattice singlet coils are mirror-distributed in both vertically and horizontally coherent parallelepiped envelopes, b) which may be tied together in a zigzagging *"Reihe sich selbst gleicher Zustände"*[19], raising from the surface in same *Zitterbewegung* 2+8+18+32+32+32+18+8+2 = 152 unit brick coherent sequence of palindromic Bohr orbital distribution as in truncated octahedron, into a trapezoid stack module able to hierarchically self-expand around a spherical IVM "hub".

polygonal crystallization reaction "between surfaces"[1,2], the pertaining alternative to the truncated octahedron's continuous outlining of the electron module in 12 × 152 steps (Figure 11a,b) is offered by the fact that the electron singlet coils both vertically and over the horizontal plane form a coherent mirror-duplicated train with parallelepiped envelope (Figures 9b, 12a) which in "*eine stetige Reihe sich selbst gleicher Zustände*" as a "*flüssig gewordene Zahl...in die algebraisch stetige form*"[19] packs a trapezoid stack of 2+8+18+32+32+32+18+8+2 unit bricks (Figure 12b), that is possible to

combine and brick-lay by itself according to the examples given in Figure 13 and many others, and which all have a central hub vacancy which in proportion fits well with the nucleon. The 12-step singlet electron coils are here

a b



c d e f g

FIGURE 13: Stacking of parallelepiped IVM modules with central hub vacancy.

pieced together as infinitesimal parallelepipeds continuously linked according to figures 9b and 11a by a non-rotating *Zitterbewegung* IVM outline (Figures 11,12) into a 1824-step half-turn + 12-step translation module with proportionally 1836 times higher inertia = lower mass in relation to the central nucleon hub per cycle, and then ready to proceed the modular course, interchangeably either side-ways, upwards or mirror-wise. It is seen that the assembly leaves a central horizontally (Figure 13b) and vertically (c,d) connected groove for the convoying IVM center. In the mirror IVM compounds reciprocal cavities appear.

The idea that electrons may be both wave functions, here the cloverleaf singlet coils, and 'transition matrix elements'[30], here the IVM modules, is not new but in the present cast embodied to a coherent lattice that corresponds to the fact and way that they tangibly weave the world. Like everything else on a digital basis they are but evading unit line bits when pursued to their origin but from there they are caught in the global phase transition "between the Plücker line geometry and a spatial geometry whose element is the sphere" by a "polygon…projection of space's straight lines into the sphere's rectilinear generatrices" that Lie's original *geometriske transformationer* in detail define".[1,2]

In this process, the other governing principle is the Bohr periodicity stratification of the assembly, where regardless of whether the building blocks are conceived as points or bodies the pattern is iterated from the elementary particle stage to and beyond the tenthousandfold larger atoms by self-similarity (Figure 11c). In one simultaneous moment, the phase transition mechanism, like "the instant change of water to ice from hence isotropically dispersed origins at once inflated over the entire surface of a freezing lake"[12] lines up the primordial Universe almost entirely by the Hydrogen ion module in a serpentine fashion that reminds of the "3D island growth…pathway of layered growth" (Figures 9-13) recently described at "angstrom-scale (and even single-atom scale) resolution"[31,32] in surface crystallization processes, where "the growth units are individual molecules and ions that attach in monomolecular steps present on a crystal surface".[lb.] The modus operandi is identical, with topographical "step heights, terrace widths, and other surface features"[lb.] coming up in perpetual cycles from the very ground. Comparison with the myriad times smaller and more complicated strings also overcomes the possible objection that such intricacy could not happen at such diminutive scale.

That would be all, however, at this initial stage in which the modules just wind up their own isotropically dispersed space quota - and nothing else. But such perfect equilibrium cannot prevail indefinitely. There is bound to be some inhomogeneity in it, engendering first quite small local fluctuations, then condensations, perturbations, collisions; until at places and all at the same time the nucleogenetic furnace ignites, for which the present model also has a counterpart (Figure 14).[14,15,27] It starts where hydrogen ions are forced together at enough

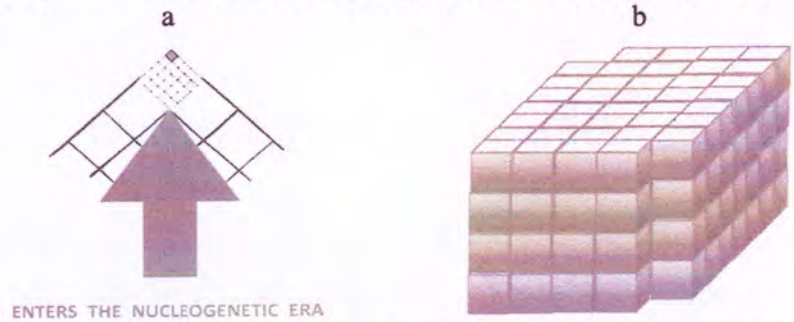


FIGURE 14: a) Equatorial plane cross-section of dismantling extrusion squeeze exerted by condensation impact in the nucleogenetic era in which b) the crystal seed may adapt to stratified type of IVM spaceframe layer growth.

pressure to fuse, squeezed against each other along the primordial expansion cone (Figure 11a), resulting in a gradual compression with terminal Bohr period 2, 8, 18, 32 etc.

The further nucleogenetic steps can be conjectured from known facts of the natural history of the reaction. Under the overwhelming pressure of this, the number of hydrogen ions that it is sufficient to fuse are forced to uncoil under emission of photons and neutrinos and other fragments in cycle after cycle of their respective modules till they reach the initial singlet cell in the very first one. Since this contraction is collective the reduction of the hydrogen ion cloud is automatically geared in one step behind into the module compartmentalization which thus acts as a guiding funnel. The consequence is that in the end the singlets crowd up under emission of photons and neutrinos and other linear segments in cycle after cycle till reaching the first module in a transverse packing order, filling so many apical singlet sites there as the number of hydrogen ions undergoing the fusion, that is, in precisely the arrangement of the Bohr-periodic singlet "terraces"[Ib.] (Figures 10a,b, 11b, 12).

The pressure then ejects them from that virtual nozzle as infinitesimal crystal seeds of possibly compressed shape (Figure 14b) which are stowed side by side (Figure 15) in a periodic tiling system[33,34] in order not to obstruct each other, much like an electric cable or a nerve is strung by separate fibers. In that position

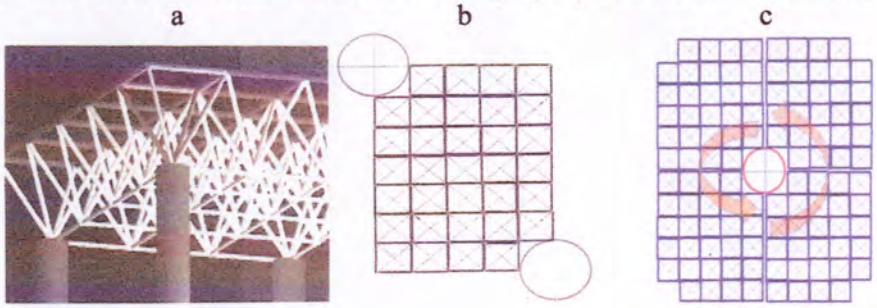


FIGURE 15: a) stratified "2D layer growth"[31,32] type of IVM spaceframe b) Cross-section of same type with two corner beam "hubs" c) By that self-organized "cube-oct"[35] build the spiral variety of surface crystal growth can proceed by stacking of the bricks like a spiral flight of stairs.

they are free to expand again by an identical non-rotational half-turn Zitter-bewegung sequence in each so that they don't counteract in that way either but proceed in parallel. Just as in reality and here first illustrated in a paired variety of periodic table layout with special reference to the noble gases.[14,15,27] First illustrated (Figure 16) is a paired variety which results when two modules are

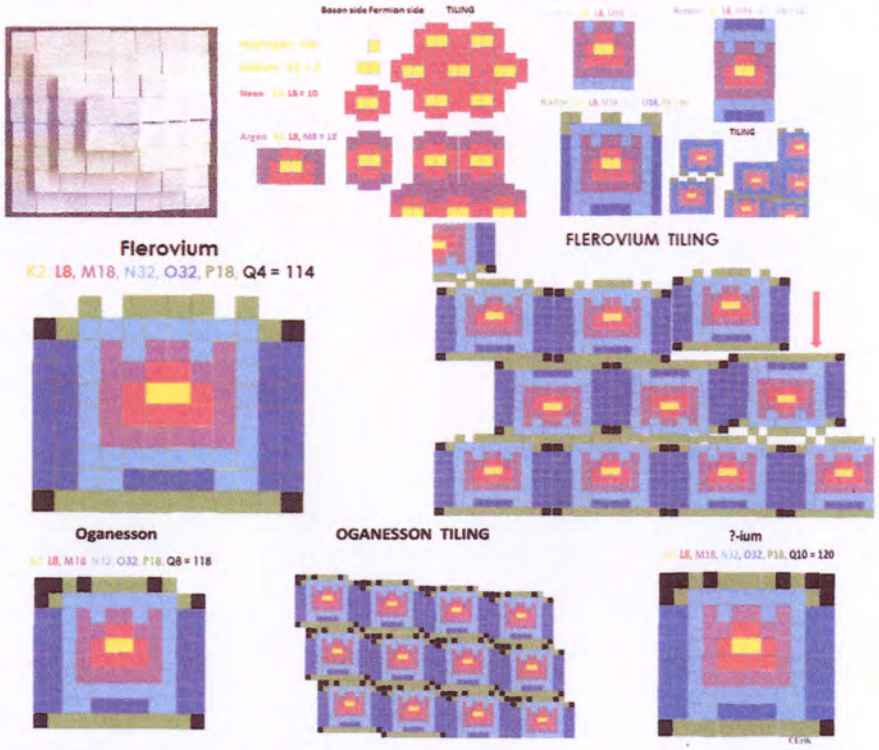


FIGURE 16: Frontal plane chart of the noble gases in a double-module (see upper left) extrusion. The coloring is according to the amplified color of the gas in the scintillation tube. It is implied that the noble gases are saturated and released when a delivery pulse has been completed, and that they tile.

sandwiched (see top left in the figure) so that the shelves can be unloaded in alternation and add to the previous amount. The atoms that they form by the number of them going through the reaction is therefore presenting as a cross-

section front just as in reality and they would also share the quantum mechanical uncertainty and other characteristics from the size difference between their "grains"[21] and the colossally larger probing instruments available. It is proposed that the stacking is by self-assembly according to the "spiral growth model…of 2D layer growth"[31,32] by square-octagon periodic tiling principles[33,34] in a "cube-oct" structure build[35] (Figure 14), as recently reported from the suitably named *Center for Atoms and Bits* at MIT[lb.] and originally prescribed by Marius Sophus Lie in his thesis "*Over en classe geometriske transformationer*".[1,2]

From the two halves of the front terrace two Hydrogen ions and one Helium atom are delivered, and the second half-terrace adds eight more seeds forming Neon. Then eight more are emptied from the flanking half-terrace so that Argon is formed. From the next half-terrace comes 18 seeds into Krypton and from the other 18 more to Xenon. Then the fourth delivers 32 to Radon and its moiety its 32 to Oganesson, that tiles although not having quite reached quadratic form which would happen at atom number 120. Before, Flerovium occurs at atom number 114 and is readily tiled as a noble gas, too.

The periodic table can also be realized via a single module[14,15] (Figure 17) by a sequential extrusion obliquely from the core around occupied outer layer(s)

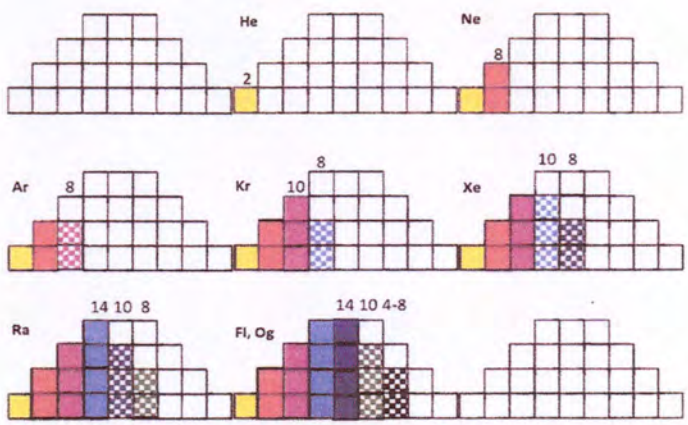


FIGURE 17: Lateral projection of noble gas extrusion from single module in the reciprocal order to how the singlet cells and terraces accumulate therein (dotted are internal layers). It is seen that the atomic periods, each terminated by a 'saturated' noble gas are filled obliquely like a conifer.

and then back to and emptying the core which when all layers are full completes a noble gas period. The bilateral nozzle shape of the module means that the singlets are propelled after each other towards the outlet and thus automatically arranged alternatively as fermions and bosons, to the latter category all noble gases in ground state then belong. The resulting periodic table, still represented by the noble gases (Figure 18), displays the bilateral meridian parity that signifies material compounds and organisms in general.

Referring to Figure 12a, this parity is even inherent in the longitudinal growth sequence in every direction of the electron singlets when two sheets are distributed pairwise to a spacefilling module according to the layout shown in a

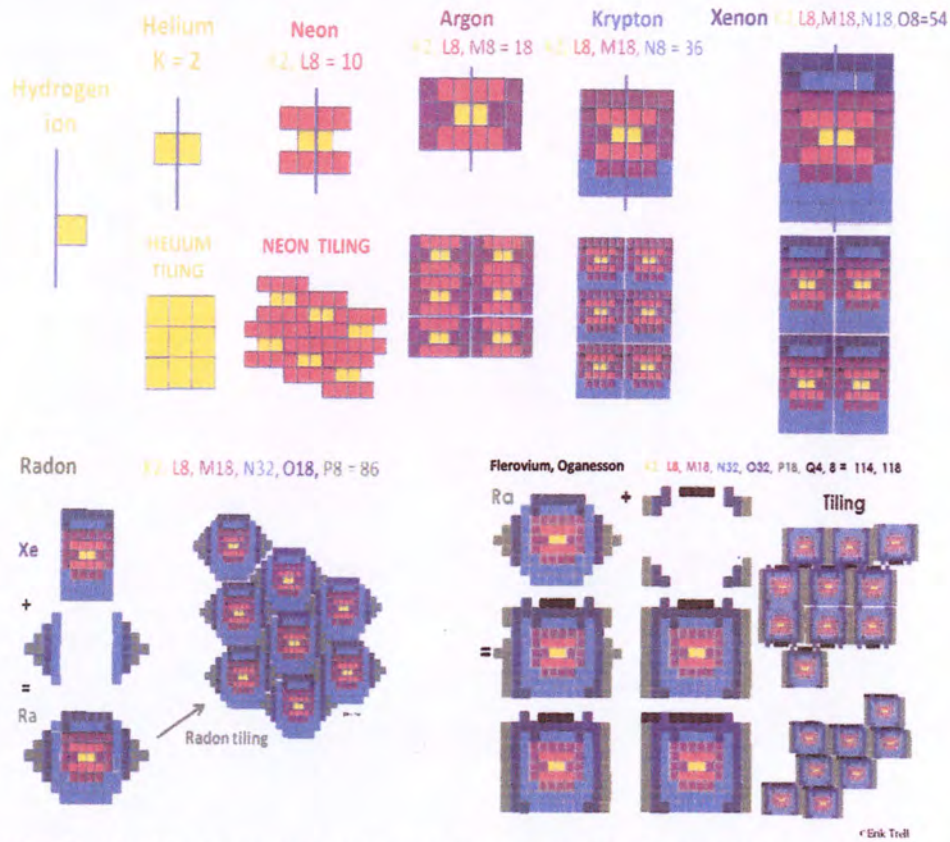


FIGURE 18: Single-module noble gas extrusion with alternative form of Radon.

lateral projection in Figure 19. This would be the slimmest module organization

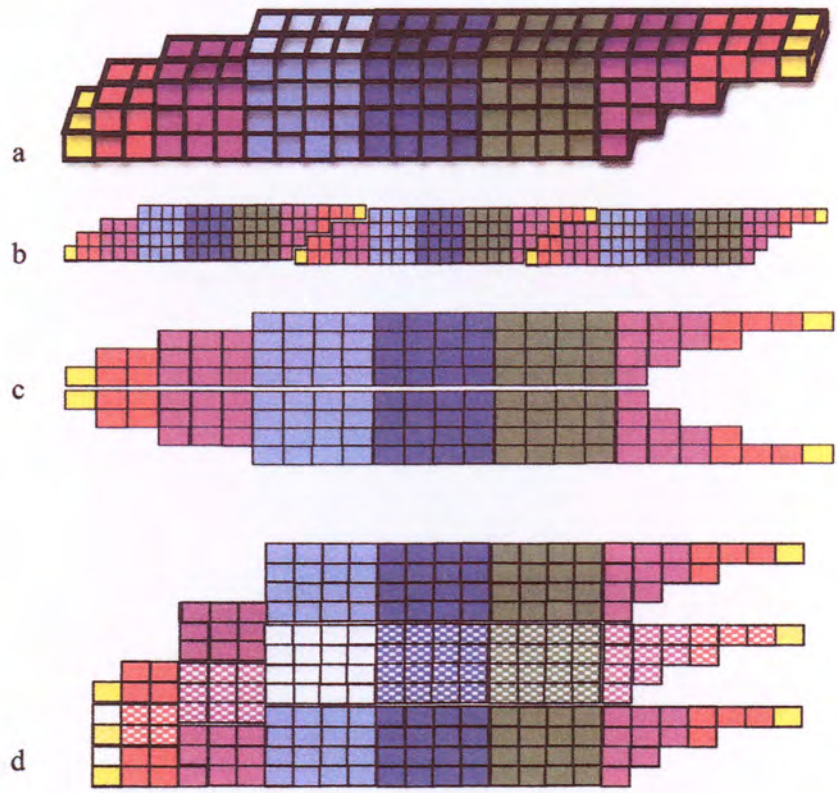


FIGURE 19: a) A longitudinal duplication of the electron module train along any spatial axis (here the horizontal) ensures parity and space-filling also in aggregation by repeating the duplication transversally or b) longitudinally or c) by reflection. d) The modules may also be stacked upon each other.

and automatically ensure parity and smooth spacefilling accommodation over the right-angled axis. However, at the present stage it is just a variation of a general plan, indicating the scope of a sequential deposition of the nucleon elements in

pulses determined by their amount and ordering in the extrusion of them. The principle is a stepwise marginal accretion and build-up of the crystal seeds determined by the successive emptying of the module terraces (Figures 17,19). The positions along the margins of the so accumulating grid may vary in the respective individual atoms but when reaching the end of a cycle, i.e., a noble gas, there should be an 'island of stability', settling the cycle and starting a new with each new square added to the table according to the spiral growth mechanism (Figure 20) observed in near-atomic "angstrom scale surface crystallization processes" in reality.[33,34]

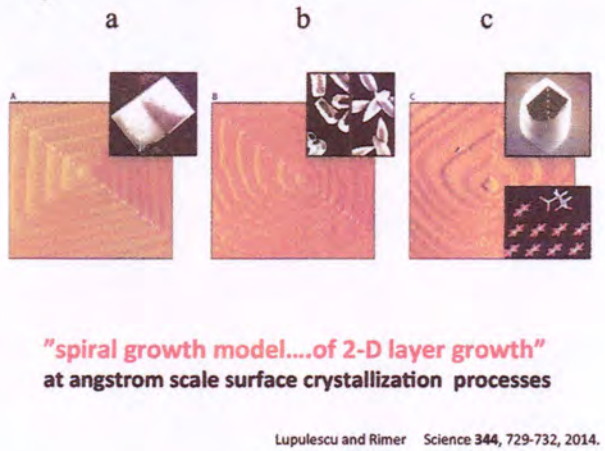


FIGURE 20: 2-D spiral model of ground-up crystal growth.

This is doubly relevant because it is in tune with the structuralist view of atoms prevailing in the pre-elementary particle era and which was shared by Mendeleev. For the eight elements he predicted, he used the prefixes of eka, dvi, and tri (Sanskrit one, two, three) thus "showing his appreciation and debt to the Sanskrit grammarians of ancient India, who had created sophisticated theories of language based on their discovery of the two-dimensional patterns in basic sounds…he noted the comprehensiveness of the two-dimensional arrangement of the Sanskrit alphabet…The tabular form of the Sanskrit letters is due to the two parameters (point of articulation and aspiration) at the basis of the sounds, and Mendeleev must have recognized that ratios/valency and atomic weight likewise defined a two-dimensional basis for the elements".[36]

When accordingly Mendeleev "arrived at his discovery through a search for the 'grammar' of the elements"[lb.] this also implies the atomic scripture and its, literally, imprinting the atom crystallization. Figure 20a is the version most closely corresponding to the present effectuation where the zigzagging IVM electron-proton *Zitterbewegung* core (Figures 11a, 12a) is surrounded by the likewise unit length orthogonal Euclidean space axis vectors (Figure 12a), which thus have the signature of the neutron. They integrate to the walls of the periodic table cells, and grow together with the proton/electron core so they get equivalent inertial expression along the propagation axis. Figure 21 summarizes the nucleon scaffolding that the neutron provides, and that it takes two neutrons to fully enclose a CuBit unit.

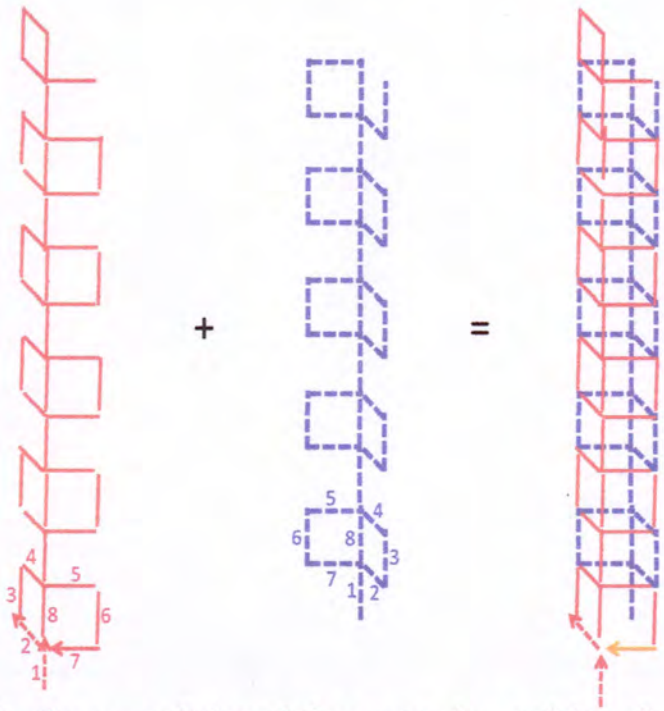


FIGURE 21: Continuous outlining of the neutron in a straight realization. It is seen that two neutrons are needed to enclose a Cubit.

From Figure 12 can be inferred that successive/adjacent modules may share the coat between them whereas others, especially at the edges carry a double set. Figure 22a shows that the Euclidean coating may also be distributed in a Peano type cube-filling Hilbert curve path, that may expand in periodic recursion levels

a b

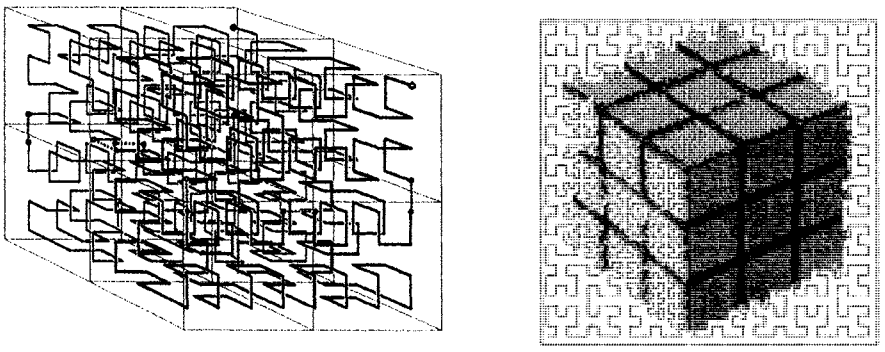


FIGURE 22: a) Cube-filling Hilbert curve neutron variety. b) Hilbert curve neutron geodesics between four and eight levels of recursion.

corresponding to the "2-D layer growth" of the periodic table squares (Figure 22b). Both in the straight and the angled variety it can be deduced that the path can go along till interfering with some global pattern that makes it break up to a stable proton trajectory, which, on the other hand, can only proceed in isolation whereas the neutron may join with other neutrons into permanent aggregations that may reach stellar, i.e. nucleon star size.

Figures 15 b and c give a cross-section summary of the hybrid crystal seeds and their layer growth emerging from the dynamic cracking and extrusion transactions in the nucleogenetic process (Figure 14a). Both the complementary quark core and Euclidean space frame infinitesimal eigenelements of "straight "geodetic curves of length equaling zero"[1,2] would come out of it separate or in combination and then gather into the periodic table. One could anticipate several qualitative features of this dispensation which match with reality. With increasing atomic number there would be a tendency to neutron excess, i.e. a surplus of bilaterally enclosing versus central core unit vectors in the propagation. And in the nucleogenetic squeeze (Figure 11c) additional excesses of isolated neutron as well as proton elements can be forced out, too, generating the wide range of isotopes and their decays observed in practice.

Moreover, as shown in Figure 17 the extrusion sequence from a nucleogenetic module gets a periodicity from the terrace structure of this so that the emptying of a core octet concludes a saturated level of recursion (Figure 22b) with resulting optimal periodic tiling dispersal in a flat tabular design (Figure 20). This correspond to the successive noble gas "islands of stability" where the actual tiling into free mixing with the environment can happen after fewer layers of growth with consequential smaller nucleon size. But after each noble gas, the next larger atom gets an asymmetric protruding form and has to go into more layers of growth to a larger size and harder, metallic consistency to blend. Towards the ensuing noble gas, additional marginal crystal seed pegs and from halfway on gaps between them would replicate binding properties and also the renewed gradual size shrinking and mollification most apparent in the penultimate halogen site until the next noble gas

This is of course a very crude, qualitative sketch but it supports that the two-dimensional, tabular outline of the periodic system may also be a constructive plan of the nucleon constitution for further study, quite in concordance with the original Mendeleev conception. That both protons and neutrons can be realized as pivotal realizations of the unit straight line means that the whole elementary particle and atomic/molecular spectroscopies can be unified under one single eigen-element and self-organization principle. Both the neutron and the proton-electron complex has an one-dimensional lepton constitution which allows an exploration also into the "hot nuclear matter"[37], i.e. the "echo of the hidden valley"[38] of the intra-nucleon excitations, where the leptons and their *u,d,s* and also *c* (the median diagonal axis H_2 in figure 3a) and *b* quark axes[12,15-18] are directly participating as strings and nodes in the resonances.

The infinitesimal straight line thus runs through all atom compartments as the irreducible ground element in them. A stepwise lepton concatenation has been followed outwards for the electron to the periodic table. In the generation of this also the photons and neutrinos were appearing as one-dimensional zig-zag and straight differential intervals, excised in various transmutation events and with mass expression in relation to proton = 0 due to the infinite span of their iterated square wave and rectilinear geodesics, respectively. Further examples of the photon and neutrino differential processes abound over the elementary particle spectroscopy (Figure 23a) and also between the leptons themselves (Figure 23b). One may therefore say that the leptons are the beams of the entire IVM construct from the periphery to and even inside the hub[9,19,22-27] of its repetitive sections, which makes a probing of this, above all under high-energy collision experiments

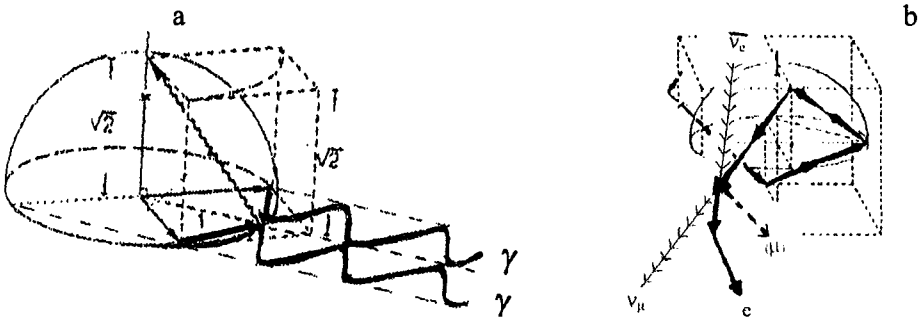


FIGURE 23: a) Example, in the neutral pion, how photons are generated when root vectors in e.g. particle decay or Brehmsstrahlung bending within same charge plane snap back to their space axes setting up a zig-zag ripple between them of infinite length, thus zero mass and amplitude/frequency also determinable. b) Example how a transition of, in this case, the muon into the electron leaves straight forward and backward momentum vectors corresponding to muon neutrino and electron antineutrino, both endlessly extending over successive space lattice intervals and hence of $1/\infty$ = zero mass and nil amplitude.

extremely complicated region[40] possible by simulation. Figure 24 gives an overview of the basic lepton tracks over the surface, interior and exterior of the

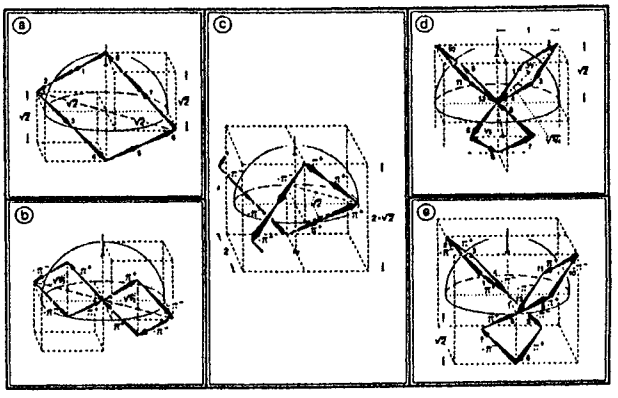


FIGURE 24: Closed and open a-c) muon and d,e electron geodesics in nucleon neighborhood.

nucleon. Both the muon, electron and tau symmetries (and by reversal antisymmetries) can be discerned, and it is shown that the unit root vector steps may be linked in closed (Figure 24a) as well as open (Figure 24c) 90°-180° and 90-90° (Figure 24b) sequences which run tangent over the outside (Figure 24a,c) versus inside (Figure 24b) of the nucleon surface, commutating with the external lattice in the corners. This follows the pattern of the muon and in all cases results in a spherical orbital length of $(2\pi \times 2^{1/2})$ and resulting mass in inverse relation to the unit radius of the proton is $1/(2\pi \times 2^{1/2}) \times 938.27 = 1/(2\pi \times 2\times 1/2^{1/2}) \times 938.27 =$ 105.59 MeV in comparison with the measured $\mu^{\pm}$ mass of 105.66 MeV.[9-12,16,29]

When instead the $60^{\circ} - 120^{\circ}$ inclined root vector junctions are linked, a $3 \times 4 = 12$-step cloverleaf loop of three angled rhombi with major semiaxis $= 2^{1/2}$ and minor semiaxis $= 1/2^{1/2}$ results, forming a closed 'rosette' coil in the nucleon (Figure 24d), or a tripod helix out of it (Figure 24e) which is isomorphic with the octahedral-tetrahedral singlets in the IVM module aggregation (Figures 9-13) and free to join it and its mass expression.

The central rosette (Figure 24d) adds to the number of intranucleon vector elements, and may also be engaged in experimental and cosmic ray elementary particle reactions, notably in the infrequent but comparatively regular formation of the tau lepton resonance[12,18] in high-energy electron/positron collisions or as decay intermediate in many other processes, e.g. from the gauge vector bosons. In all the three electron rosette planes and the three planes of the moiety will be mutually piled into the spatial neighborhood of their occurrence and recording so that their major axis along the central diagonals assume a length of $2^{1/2}$ meaning that their four enclosing unit root vectors form a square of unit area giving a total area 6×1 of the short-lived event before in bursts into the plethora of decay modes of $\tau^{\pm}$ including many mesons, e.g. kaons, the charmed D meson (which is close in mass and behavior), pions and so forth. This shows that the tau is really a cross-over to the mesons and it is governed not by the antisymmetric U(1) group but by the symmetric SU(2) group. This is manifested by its mass being directly proportional to that of the unit proton by the relation to the area of the equatorial plane of this ($= \pi$), which gives the extremely simple formula $(6/\pi) \times$ proton mass ≈ 1.79 GeV which is within per mille of the observed 1.78 GeV.[1b.]

The scarcity of the tau production is readily understood by the much more likely particle/antiparticle annihilation or scattering from more direct hits, so that it must be the effect of slanted, perhaps tangential shedding events wrapping up the envelopes to their quite short-lived resonance before bursting into their

possible decay jets, which are a veritable legion, mostly leptonic but many mesonic also – and to which there are enough vectors and their combinations in the unit step sequences of the three-foil sides of their planes.

When allegorizing the nucleon in its high-energy interactions as a resonating instrument[27] with extra variation due to the contour changes of its belly in the baryon/hyperon/resonance geometrical transformation series[9,19,22-27], the axes, likewise with further modulations in corresponding realignement, exhibit themselves as the strings, chords, pipes; much like the gluon tubes in quantum chromodynamical (QCD) quark confinement.

So, when the new high-energy particle physics penetrates and probes the interior of the particles at hand, the resonances and other "exited states"[37] that are elicited from there as "echoes of the hidden valley"[38] are possible to infer from a classical geometrical protocol which then in reverse serves as an important support and verification of the theories it emulates. This is true also for remaining states, such as the *top* quark which in many ways is radically different from the others. It does not hadronize, so it behaves one-dimensionally and also its mass at 173 GeV is quite discontinuous, making one wonder whether it is created by the typical proton-antiproton collision producing it cutting in so extremely deep at that ultrahigh energy that it constricts a single, predominantly *bottom* axis so much that it is squeezed out as a bidirectional ray beaming into the still invisible *top/antitop* 'switchboard', whose existence is manifested only by the signature of the decay channels.

Its energy is so high that it surpasses even the 125 GeV of the Higg's particle, which might then rather be involved in some superposition of the $W^{\pm}$ (80.4 GeV) and Z (91.2 GeV) gauge vector bosons. These were first discovered in proton-antiproton experiments at 630 GeV in the early eighties as the inferred mediator vectors of the weak interaction in neutrino emission and absorption ($W^{\pm}$) and scattering (Z), and have faithful geometric matches, too[12,15-18], as summarized in Figure 25. The totality of interconnecting difference, i.e. indeed gauge, vectors between the isospin structures in the nucleon, and corresponding to neutrinos and photons, are compiled in a diagonal and orthogonal projection, respectively, and demonstrate how intricate and rich the intranucleon organization really is. It is understood that at the high energy level of the collision either of these alternative ensembles may be liberated like when the pins are knocked down backwards or sideways by a matching impact in a bowling strike. In their nucleon encasement all the 'pins' have a defined length and corresponding mass value in relation to the proton radius and it is therefore possible to add them together in their

release. Since previously reported[12,15-18] only the gross calculation will be recapitulated, which in $W^{\pm}$ is $2 \times [36 \times 0.93827 + (10 \times 2^{1/2}) \times 0.93827]$ GeV $\approx$ 80.8 GeV versus the measured 80.4 GeV. In Z, the result is also within per mille precision; $2 \times [44 + (6 \times 2^{1/2})] \times 0.93827$ GeV $\approx$ 90.5 GeV versus the observed 91.2 GeV.

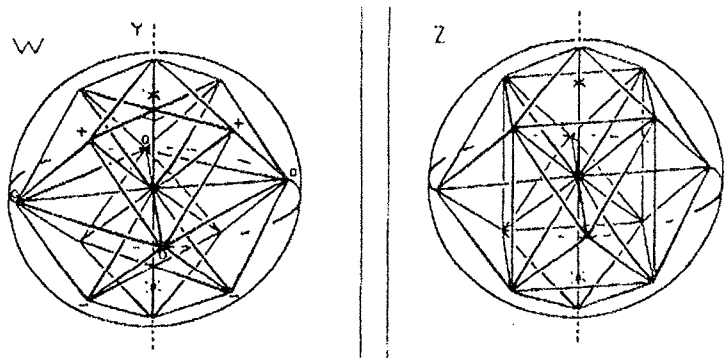


FIGURE 25. Total gauge vector collection in W and Z (one-dimensional Clifford algebra of straight line mono-vectors).

When these straight difference vectors are released from the nucleon in the strike they continue outwards in straight (neutrinos of the various kinds) or zig-zag/sinusoidal (photon) iterations and hence of infinite length and mass expression $1/\infty \times 0.93827$ GeV = 0 GeV. It is true, that the scenario might now seem to be both fanciful and panegyric but it is in double sense strikingly analogous to what at extreme temperature is seen and portrayed in e.g. "hot nuclear matter", where ordinary "transport theory describes the conversion of the gluon fields in the incoming nuclei into thermal QCD matter, the expansion of the quark/gluon plasma and finally its disassembly into hadrons" in two types of "anisotropic collective flow", whose "elliptic and triangular flow patterns arise from the location of the individual nucleons at the instant when two nuclei interpenetrate".[37,38]

Even in that intense climax of temperature and pressure, the nucleon thus persists and counters by a veritable riposte to the thrust. It cannot be hammered out of existence and in its situation of no retreat it can only resound from its dead end valley[38] according to what could be called its acoustics architecture.[18] It is

really remarkable how the standard and geometrical models duplicate each other in this vital respect. As mentioned, it is not the purpose here to go into detail, but the accordance reaches from the outside and surface ordinary elementary particle spectroscopy shape transformations at relatively low energy via the transmembrane, e.g. tau, *charm* and *bottom* events, to the inside as modulated by the interior x,y,z and *u,d,s* axis and other string and resonance framework and walls of the virtual echo grotto itself. Also the highest energy outcomes like sea partons and glueballs and exitons and the like can find accumulation and backfire mechanisms such as, besides those mentioned in the text, laser processes etc. Indeed, a prosperous territory opens for wide and far extended charting.

Discussion

Here has been indicated that the straight line of infinitesimal length "equaling zero"[1,2] can indeed simulate the entire microcosm and that this is in harmony with Mendeleev's linguistic concept of the periodic table as formed by a kind of script - today an ink jet or laser beam - upon an advancing page according to a common coherent world code. This is the structuralist view that all Nature's manifestations, physical as well as mental must be understood in terms of a larger, overarching principle. In the current postmodern era this tenet comes back, offering a more consistent system than the detached and merely by coincidence congruent plethora of diverse particles, and founded upon classical learning and tradition. Examples include the reaffirmed African "'Ichi' linguistic geometry and evolution"[39-43], the "differential epistemology" of fundamental logics and change[44], and the novel "nilpotent algebra"[45], which all generate self-sustained vector spaces of structuralist compass.

It is "back to the ether"[46] and to the thoughts of Mendeleev's time, when already in 1815 William Prout proposed that the atoms are conglomerates of equally many hydrogen ions as their atom number[47]. However, the idea was contradicted by its inconsistency with ensuing experimental data and their first-hand interpretation. The discovery of isotopes gave renewed support, recently strengthened by number theory[48], but it has been hard to figure out ways and means of structural realization. In 1987, Helen Pawlovski presented a circular model of the atom[49], which is a flat cross-section distribution of electrons in centrifugal orbits packed according to a zig-zag *Aufbau* order of octagonal symmetry. In an implied cubical space installation this has much in common with

the here advanced model – and with periodic tiling – but it doesn't represent the isotope spectrum, the nucleon patterns or the neutron excess.

This can be accomplished by the present regular scientific method, and results in reproducible objective facts and findings alone. The provenience is eminent, too; right from the ancient origins to ultramodern nanotechnology and the complete experimental and observational evidence. And the progenitors are likewise the most eminent and relevant, and in particular so Hermann Günther Grassmann and Marius Sophus Lie whose works have been followed in detail in their rationale that Reality has "*ihr Wesen und Dasein in sich selbst*" and therefore can be emulated as has been done here directly "*in ihrer konkreten Gestalt.*[19] That space has an intrinsic eigen-structure crystallizing and crystallized by its self-similar infinitesimal eigen-element already at the bottom, shapes up a veritable nanotechnology construction kit whose bits just like in laboratory "layer-by-layer growth of binary colloidal crystals"[50] and "self-assembly of polymeric supramolecules…form assemblies or self-organize, possibly even forming hierarchies"[51] of themselves.

Also the philosophical endorsement of the universally generating phase transition between straight and round and the fundamental regular solids and their symmetries and formative unit line element reverberates through all cultures[9,27,37,46], and remarkably subsist in virtual Rosetta stone original terms from times immemorial in the "African perspective on the theory of everything"…."based on cube-hexagon hyperspace/torus geometry in which space-time quantization into a lattice is achieved according to modern solid state physics and hadronic mechanics of extended (string-like) elementary particles..(with)..complementary duality of leptons and baryons"[39-43] quite like in the present version.

From these roots, the thread weaves its permeating fabric from the inorganic to the organic realm meeting up with still from above approaching nanotechnology so that, for instance, the "LEGO-like…fabrication of three-dimensional structures from DNA bricks"[52,53] now going on in the frontline there can be refined by the thousand-fold tinier but yet concrete compilation of DNA itself by its constituent solids as originally devised by Hill and Rowlands.[45,54] And there is no egg and hen dilemma because regardless of which is the blueprint of the other, the fact that, as pointed out by Rowlands, both the standard model "approach and Trell's…are based on the same theory (QCD), then we should expect a correspondence".[45]

The most striking and truly innovative correspondence is the retrieval of the

neutron as well as the proton as complementary, iso-doublet deployments of the line, exactly filling their niche and role on the scene and periodic table alike where, as in reality, "neutrons are required for the stability of nuclei" [55] with a "skin"[Ib.] that in the projection here appears as a scaffold around the proton 'marrow' of the periodic table squares without changing the topography of binding sites and other features.

It should be most worthwhile to continue with the strictly scientific exploration utilizing the objective falsification method in search also of the deeper mathematical patterns and algorithms involved. These are to be found in Santilli's uniquely Lie-admissible iso-, geno- and hypermathematics[56], which Popper himself found to offer the ultimate solutions of the field[57], including antimatter, quasicrystals and "extended, and therefore deformable particles".[56]

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GENERATING WORMHOLES SOLUTIONS TO THE BRANS-DICKE THEORY

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Abstract

In this note, we use the generalized static spherically symmetric vacuum solution to induce a wormholes geometry by cutting and pasting two manifolds, which is originally Riemannian. The new geometry obtained here can be consider as a generalization of composite vacuum Brans-Dicke wormholes. Based on these results, we further propose the stability analysis of these wormholes to linearized spherically symmetric perturbations around static solutions. The equation of state $P = \beta^2\sigma$ at the throat is linearized around the static solution where σ energy density of the shell and P the lateral pressure.

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1 Introduction

In previous work [8], we considered the simple Heckmanns vacuum wormhole solution of Jordan-Brans-Dicke theory. It was shown that in contrast with class I Brans solution where the throat radius becomes real when $\omega < -4/3$ here it becomes positive when $\omega < -1$. In this paper, we extend the analise of [8] to the case in which the wormholes includes a thin shell between two manifolds which is the generalized static spherically symmetric vacuum solution.

Wormholes are very popular topic to the researcher for last two decades. After the leading work by Moris and Thorn [9], wormhole connecting two asymptotically flat spacetimes is now well known classic in relativity theories. A powerful theoretical method for constructing and analyze wormhole geometry, introduced by Visser [13, 14], is by cutting and pasting two manifolds to form a geodetsically complete one. It is well known that wormhole within the framework of general relativity always requires the presence of exotic matter [13]. On the other hand wormholes have some issues such as the violations of energy conditions, the mechanical stability etc.

To describe a thin shell Brans-Dicke wormhole configurations one may construct such system by two distinct strategies. Actually, the essence of the standard method is the following: One takes two the same copies of spacetime manifolds with appropriate asymptotics, cuts and casts away 'useless' regions of spacetimes (containing horizons, singularities, etc.), and pastes remaining regions. As the result, one obtains a geodesically complete wormhole spacetime with given asymptotics (Schwarzschild, Reissner-Nordstrom, Brans-Dicke, etc.) and a throat being a thin shell of exotic matter violating the null energy condition. In other case, we have initially a thin shell made from *ordinary* matter, and then we look for appropriate interior and exterior Brans-Dicke solutions [1, 2] matched at the shell [12].

The thin-shell Brans-Dicke wormholes considered in the literature [4, 15]. This approach is similar to the problem of a thin shell in general relativity [7] but, the difference is that the Birkhoff theorem is not valid in Brans-Dicke theory, and so both the interior and exterior Brans-Dicke vacuum are not unique.

It is then important to know wether such wormhole are stable. Stability

analysis of thin shell wormholes under small perturbations around the static solution has been done previously by several authors. In this paper, the stability of composite vacuum Brans-Dicke wormholes is analyzed under linear perturbation preserving the symmetry.

2 Construction of the Brans-Dicke composite thin shell wormholes

Let us consider Brans-Dicke theory [5]. The field equations are stated next:

$$G_{\mu\nu} = \frac{1}{\phi}T_{\mu\nu} + \frac{\omega}{\phi^2}\phi_{,\mu}\phi_{,\nu} - \frac{\omega}{2\phi^2}g_{\mu\nu}\phi_{,\alpha}\phi^{,\alpha} + \frac{1}{\phi}\phi_{;\mu;\nu} - \frac{1}{\phi}g_{\mu\nu}\phi^{;\alpha}_{;\alpha}, \quad (1)$$

$$\phi^{;\alpha}_{;\alpha} = \frac{T}{2\omega+3}, \quad (2)$$

where R is the scalar curvature, ϕ is a scalar field, ω is a dimensionless coupling parameter and $G_{\mu\nu} = R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu}$ is the Einstein tensor, and $T = T^{\mu}_{\mu}$ is the trace of the matter energy momentum tensor $T_{\mu\nu}$[1].

We shall consider the matching of two static and spherically symmetric spacetimes. From the mathematical point of view, the most simple and satisfactory expression for the matching conditions is, following Linchnerowicz, the assumption that there exists a system of co-ordinates in which the metric tensor satisfies the continuity conditions. Let ξ^i be a coordinate system on Σ where Σ is an abstract copy of any of the boundaries. Continuity conditions require a common coordinate system on Σ and this is easily done if one can set $\xi^i_+ = \xi^i_-$.

Let $(V^{\pm}, g^{\pm})$ be four-dimensional spacetimes with non-null $\Sigma^{\pm}$. The junction/shell formalism constructs a new manifold $\mathcal{M}$ by joining one of the distinct parts of V^+ to one of the distinct parts of V^- by the identification $\Sigma^+ = \Sigma^- \equiv \Sigma$. The matching conditions require the equality of the first and second fundamental forms on $\Sigma^{\pm}$. There are unique (up to orientation) unit normal vectors ${n_{\pm}}^{\alpha}$ to the boundaries. We choose them so that if ${n_+}^{\alpha}$ points towards V^+ then ${n_-}^{\alpha}$ points outside of V^- or viceversa. Clearly the

[1]Units $8\pi G = c = 1$ are used throughout the paper. Greek indices range over the coordinates of the 4-manifold and Roman indices over the coordinates of the 3-surfaces.

sign of the normal vectors are crucial since e.g. n_α^- points away from the portion of V^- which will be used in forming $\mathcal{M}$. The three basis vectors tangent to Σ are

$$e_i^\alpha = \frac{\partial x^\alpha}{\partial \xi^i} \tag{3}$$

which give the induced metric on Σ by

$$q_{ij} = \frac{\partial x^\alpha}{\partial \xi^i}\frac{\partial x^\beta}{\partial \xi^j} g_{\alpha\beta}. \tag{4}$$

The extrinsic curvature (second fundamental form) is given by

$$\begin{aligned} K_{ij} &= \frac{\partial x^\alpha}{\partial \xi^i}\frac{\partial x^\beta}{\partial \xi^j}\nabla_\alpha n_\beta \\ &= -n_\gamma\left(\frac{\partial^2 x^\gamma}{\partial \xi^i \partial \xi^j} + \Gamma^\gamma{}_{\alpha\beta}\frac{\partial x^\alpha}{\partial \xi^i}\frac{\partial x^\beta}{\partial \xi^j}\right). \end{aligned} \tag{5}$$

Then matching conditions are simply

$$q_{ij}{}^+ = q_{ij}{}^-, \tag{6}$$

$$K_{ij}{}^+ = K_{ij}{}^-. \tag{7}$$

If both (6) and (7) are satisfied we refer to Σ as a boundary surface. If only (6) is satisfied then we refer to Σ as a thin-shell.

Writing two static spherically symmetric spacetimes V^+ and V^- with signature $(-+++)$. one can suppose that the metrics $g^+_{\alpha\beta}(x^\gamma_+)$ and $g^-_{\alpha\beta}(x^\gamma_-)$ in the coordinate systems x^γ_+ and x^γ_- are of the most general forms

$$\begin{aligned} ds^2 = &- f^\pm(r,t)dt^2 + g^\pm(r,t)dr^2 + u^\pm(r,t)drdt + \\ &+ h^\pm(r,t)\left(d\theta^2 + \sin^2\theta d\varphi^2\right). \end{aligned} \tag{8}$$

where $f^\pm(r,t), g^\pm(r,t), u^\pm(r,t)$ and $h^\pm(r,t)$ are of class C^2. However, in what follows, we will restrict ourselves to static spacetimes with $u^\pm(r,t) = 0$ because that is sufficient for our illustrative purpose.

Within these spacetimes define two non-null 3-surfaces Σ^+ and Σ^- with metrics $q^+_{ij}(\xi^k_+)$ and $q^-_{ij}(\xi^k_-)$ in the coordinates ξ^k_+ and ξ^k_- which decompose each of the 4-spacetimes into two distinct parts. The parametric equation for hypersurface Σ is of the form

$$F(x) = r - a = 0. \tag{9}$$

in which case the throat is located at a constant radius a. The norm to Σ can be written as

$$n_\mu = -\sqrt{g(r)f(r)}\dot{r}dt|_\Sigma + \sqrt{g(r)(1+g(r)\dot{r}^2)}dr|_\Sigma\,. \tag{10}$$

The induced metric on the Σ by the two solutions (8) is

$$q^\pm_{ij}d\xi^i_\pm d\xi^j_\pm = -f^\pm(r)d\tau^2 + h^\pm(r)\left(d\theta^2 + \sin^2\theta d\varphi^2\right) \tag{11}$$

therefore we must have on the Σ according to equality of the first fundamental form

$$f^-(a) = f^+(a), \quad h^-(a) = h^+(a) \tag{12}$$

Note that this approach not required a continuity the $g^\pm(a)$. Moreover, Brans-Dicke scalar field should be continuous around the shell, however, field values on the inside and the outside of the shell do not necessarily have to be same [5]. We can impose that the Σ be also characterized by equality of the second fundamental form too. This condition leads to

$$K_{11} = \frac{1}{2}\frac{f'(a)}{\sqrt{g(a)}}, \quad K_{22} = \frac{1}{2}\frac{h'(a)}{\sqrt{g(a)}} \tag{13}$$

where prime denote derivation wits respect to a. Continuity of the second fundamental form is merely equivalent to

$$h^{+'}(a)^2 g^-(a) = h^{-'}(a)^2 g^+(a), \quad f^{+'}(a)^2 g^-(a) = f^{-'}(a)^2 g^+(a) \tag{14}$$

The junction conditions in Brans-Dicke theory (generalized Darmois-Israel conditions) can be obtained by projecting on Σ the field equations (1) [11]:

$$-[K^i_j] + [K]\delta^i_j = \frac{1}{\phi}\left(S^i_j - \frac{S}{3+2\omega}\delta^i_j\right), \tag{15}$$

$$[\phi_{,n}] = \frac{S}{3+2\omega}, \tag{16}$$

where the notation $[Z] = Z^+|_\Sigma - Z^-|_\Sigma$ stands for the jump of a given quantity Z across the hypersurface Σ, n labels the coordinate normal to this surface and S_{ij} is the energy-momentum tensor of matter on the shell located at Σ. The quantities K and S are the traces of K^i_j and S^i_j respectively. Note that Eq. (15) is equivalent to

$$S^i_j = \phi\left(\frac{\omega+1}{\omega}[K]\delta^i_j - [K^i_j]\right). \tag{17}$$

This Lanczos equations follow from the Einstein equation for the thin shell.

3 Stability condition (Linearizing method).

We let the radius a to be a function of the proper time τ on the Σ and trying to find the local stability of the thin shell under small perturbation around the static solution at $a = a_0$. The jump of the components of the extrinsic curvature associated with two sides of the hypersurface in the spacetime with the metric (8) can be found as

$$K^\tau_\tau = \frac{f(2\ddot{a}g + \dot{a}^2 g') + f'(1+\dot{a}^2 g))}{2f\sqrt{g}\sqrt{1+\dot{a}^2 g}}, \tag{18}$$

$$K^\theta_\theta = K^\phi_\phi = \frac{h'\sqrt{g(1+\dot{a}^2 g)}}{2gh}, \tag{19}$$

$$K = K^\tau_\tau + 2K^\theta_\theta. \tag{20}$$

where the overdot denotes a derivative with respect to τ.

The surface stress-energy tensor of a perfect fluid is given by

$$S^i_j = \begin{pmatrix} -\sigma & 0 & 0 \\ 0 & p & 0 \\ 0 & 0 & p \end{pmatrix}, \tag{21}$$

where σ and p are the surface energy density and the surface pressure, respectively. So $S = 2p - \sigma$. After some algebra Eq. (17) yields

$$[K^{\tau}_{\tau}] = \frac{1}{(3+2\omega)\phi}\left[(2+\omega)\sigma + (2+2\omega)p\right] \tag{22}$$

$$\left[K^{\theta}_{\theta}\right] = -\frac{1}{(3+2\omega)\phi}(p+\sigma+\omega\sigma)\,. \tag{23}$$

Rearranging the Eq.(23) one can write

$$\frac{1}{2}\dot{a}^2 + V(a) = 0\,, \tag{24}$$

By solving (23) for $\dot{a}^2$, one finds

$$\dot{a}^2 = \left(\frac{2}{(3+2\omega)\phi}(p+\sigma+\omega\sigma)\frac{h}{[h']}\right)^2 - \frac{1}{g} \equiv -2V(a)\,. \tag{25}$$

A Taylor expansion to second order to potential $V(a)$ around the static solution yields:

$$V(a) = V(a_0) + V'(a_0)(a-a_0) + \frac{1}{2}V"(a_0)(a-a_0)^2 + O(a-a_0)^3. \tag{26}$$

Differentiating (24) with respect to τ, we have

$$V'(a) = -\ddot{a}\,. \tag{27}$$

Solving (22) for $\ddot{a}$, we obtain

$$\begin{aligned} V'(a_0) &= \frac{\sqrt{1+\dot{a}^2 g}}{\sqrt{g}(3+2\omega)\phi}\left(2P(1+\omega) + \sigma(2+\omega)\right) - \\ &- \frac{\dot{a}^2}{2}\left(\frac{[f']}{f} + \frac{[g']}{g}\right) - \frac{[f']}{2fg}. \end{aligned} \tag{28}$$

It is clear that stress energy structure of the thin shell and its property are related so that an imposed equation of state will determine the stability

condition. Because of its simplicity the linear equation of state $p = \beta_0^2\sigma$ is often used with the field equations for many of applications and it is frequently used in constructing thin shell. Using the parameter $\beta_0 = \frac{dp}{d\sigma}$ which is usually interpreted as a speed of sound Eq. (16) and Eq. (28) can be written as

$$V'(a_0) = -\frac{(2+\omega+2\beta^2(1+\omega))}{(-1+2\beta^2)}\frac{[\phi']}{\phi g} - \frac{\dot{a}^2}{2}\left(\frac{[f']}{f} + \frac{[g']}{g}\right) - \frac{[f']}{2fg} \tag{29}$$

Using Eq. (16) and Eq. (28) it is not difficult to see that $V(a_0) = V'(a_0) = 0$, so the potential

$$V(a) = \frac{1}{2}V"(a_0)(a-a_0)^2 + O(a-a_0)^3. \tag{30}$$

Finally, by differentiating (29) we find

$$\begin{aligned} V''(a_0) &= \frac{(2+\omega+2\beta^2(1+\omega))}{g(2\beta^2-1)}\left(\frac{[\phi'][g']}{\phi g} + \frac{[\phi']^2}{\phi^2} - \frac{[\phi'']}{\phi}\right) \\ &+ \frac{1}{2g}\left(\frac{[f']^2}{f^2} + \frac{[f'][g']}{fg} - \frac{[f'']}{f}\right) \end{aligned} \tag{31}$$

The wormhole is stable if and only if $V''(a_0) > 0$.

4 Spherically symmetric wormholes.

We consider a thin shell between two manifolds which is the generalized static spherically symmetric vacuum solution

$$\begin{aligned} ds^2 &= -\nu_0^{\pm}\left(1-\frac{2\mu^{\pm}}{\rho(r)^{\pm}}\right)^{\frac{1}{\lambda^{\pm}}} dt^2 + \rho(r)^{\pm/2}\left(1-\frac{2\mu^{\pm}}{\rho(r)^{\pm}}\right)^{-\frac{1+C^{\pm}}{\lambda^{\pm}}} dr^2 + \\ &+ \rho(r)^{\pm 2}\left(1-\frac{2\mu^{\pm}}{\rho(r)^{\pm}}\right)^{1-\frac{1+C^{\pm}}{\lambda^{\pm}}} d\Omega^2, \end{aligned} \tag{32}$$

$$\phi(r)^{\pm} = \phi_0^{\pm}\left(1-\frac{2\mu^{\pm}}{\rho(r)^{\pm}}\right)^{\frac{C^{\pm}}{2\lambda^{\pm}}}, \tag{33}$$

where $d\Omega^2 = d\theta^2 + \sin^2\theta d\varphi^2$ is the linear element of the unit sphere, and $\rho(r)$ the arbitrary function. Generally, this solution depends on free parameters: ϕ_0, ν_0, μ, and C. The parameter λ is not free, it obeys the following constraint condition:

$$\lambda = \sqrt{(C+1)^2 - C\left(1 - \tfrac{1}{2}\omega C\right)}. \tag{34}$$

In this solution the interpretation to a choice of function $\rho(r)$ generally correspond to a choice of state within the "interior" and "exterior" vacuum. The radial coordinate r within the exterior region runs from a to infinity. We will suppose that the all metric components and scalar field be continuous on the Σ

$$f^+(a) = f^-(a), \quad g^+(a) = g^-(a), \quad h^+(a) = h^-(a), \phi^+(a) = \phi^-(a) \equiv 1. \tag{35}$$

and the exterior region does not contain the event horizon.

In our case these conditions allow us to ascertain, by selection of the free parameters, which matchings are feasible in principle. Obviously, for this case Darmois-Israel conditions [10] holds.

In particular, considering the constant C^- in the form

$$C^- \equiv 0 \tag{36}$$

considerable simplification occurs, namely the interior is described by the vacuum Schwarzschild solution:

$$f^-(r) = 1 - \frac{2M}{r} \tag{37}$$

$$g^-(r) = \frac{1}{1 - \frac{2M}{r}}, \tag{38}$$

$$h^-(r) = r^2 \tag{39}$$

$$\phi^-(r) = 1. \tag{40}$$

Assuming

$$\rho(r) = r, C = \frac{2}{\omega} \tag{41}$$

for exterior region of a spherical gravitating configuration one can obtain the exterior Heckmann solution [6] :

$$f^+(r) = \alpha_0 \left(1 - \frac{B}{r}\right)^{\frac{\omega}{2+\omega}}, \tag{42}$$

$$g^+(r) = \frac{1}{1 - \frac{B}{r}}, \tag{43}$$

$$h^+(r) = r^2 \tag{44}$$

$$\phi^+(r) = \phi_0 \left(1 - \frac{B}{r}\right)^{\frac{1}{2+\omega}}, \tag{45}$$

where ϕ_0, α_0, B, and C are free (still undefined) parameters. Note that the radial coordinate r runs monotonically from B to a, where $a > B$ is a boundary of the interior region.

We consider a thin shell between two Heckmann manifolds with exterior parameter M (Schwarzschild mass) and interior mass parameter B.

Substituting Eqs. (42) and (37) gives

$$B = M, \tag{46}$$

$$\alpha_0 = \left(1 - \frac{2M}{a}\right)^{\frac{2}{2+\omega}}, \tag{47}$$

$$\phi_0 = \left(1 - \frac{2M}{a}\right)^{-\frac{1}{2+\omega}}. \tag{48}$$

At the same time, derivatives of the metric and scalar field can be discontinuous. The discontinuity of the metric is usually described in terms of a jump of the extrinsic curvature K_{ij}.

Finally, to find stable configurations, we need to compute $V''(a)$ from Eq. (31). Substituting Eq. (42) and Eq. (37) we obtain

$$V''(a_0) = 4\mu \frac{\mu\left(5 + 2\beta^2(\omega - 2) + \omega\right) - a_0\left(3 + \omega + 2\beta^2\omega\right)}{a_0^3(2\mu - a_0)\left(2\beta^2 - 1\right)\left(2 + \omega\right)}. \tag{49}$$

By using a special forms of function $\rho(r)$ the space-time metric in both interior and exterior regions can be given in isotropic coordinates. One can

assume the function $\rho(r)$ in the form $\rho(r) = -\frac{B\left(\frac{1}{B}-r\right)^2\nu_0}{2r}$ than the interior is described by the vacuum Brans class I solution:

$$f^-(r) = \alpha_0 \left(\frac{1-B/r}{1+B/r}\right)^{\frac{1}{A}}, \tag{50}$$

$$g^-(r) = \lambda_0 \left(1+\frac{B}{r}\right)^2 \left(\frac{1-B/r}{1+B/r}\right)^{\frac{A-C-1}{A}}, \tag{51}$$

$$h^-(r) = r^2 g^+(r) \tag{52}$$

$$\phi^-(r) = \phi_0 \left(\frac{1-B/r}{1+B/r}\right)^{\frac{C}{A}}. \tag{53}$$

Note that the radial coordinate r runs monotonically from B to a, where $a > B$ is a boundary of the interior region.

Assuming $C \equiv 0$, we can obtain the exterior solution in the form:

$$f^+(r) = \frac{1-M/2r}{1+M/2r}, \tag{54}$$

$$g^+(r) = \left(1+\frac{M}{2r}\right)^2, \tag{55}$$

$$h^+(r) = r^2 g^+(r) \tag{56}$$

$$\phi^-(r) = 1. \tag{57}$$

where $M = 2B_{ext}$ is the Schwarzschild mass. We will suppose that $a > M/2$; this guarantees that the exterior region does not contain the event horizon. So, r is the global radial coordinate monotonically running from B to a in the interior region, and from a to infinity in the exterior one.

Substituting Eqs. (50) and (54) into (35) gives

$$\alpha_0 = \left(\frac{1-B/a}{1+B/a}\right)^{\frac{A-1}{A}}, \tag{58}$$

$$\lambda_0 = \left(\frac{1-B/a}{1+B/a}\right)^{\frac{1+C-A}{A}}, \tag{59}$$

$$\phi_0 = \left(\frac{1-B/a}{1+B/a}\right)^{-\frac{C}{A}}. \tag{60}$$

Finally, to find stable configurations, we need to compute $V''(a)$ from Eq. (31). Substituting Eq. (50) and Eq. (54) we obtain

$$\begin{aligned} V''(a_0) &= \frac{1}{(a_0-B)^4(a_0+B)^2\lambda^2}\Big(-2a_0^2B(\lambda-1)(a_0\lambda-B(1+C+\lambda)) \\ &+ \frac{4a_0^2BC(a_0\lambda+B(\lambda-1-C))\,(2+\omega+2\beta^2(1+\omega))}{2\beta^2-1}\Big) \end{aligned} \tag{61}$$

5 Stability regions

To find stable configurations, we need to consider all possible constraints. The wormhole is stable if and only if

$$V''(a_0) > 0. \tag{62}$$

The boundary of the region of stability is given by the surface

$$V''(a_0, \omega, \mu) = 0. \tag{63}$$

We shell now study this equation in detail. Under standard physical circumstance the shell made from a perfect fluid with the barotropic equation of state $p = \beta^2\sigma$ with $0 \leq \beta < 1$.

Let us assume the case of Heckmann wormhole. To avoid singular behavior of the metric, the radius of the throat must satisfy

$$a_0 > 2\mu. \tag{64}$$

This conditions gives some possible cases accordingly to the value of coupling constant ω

1. Case $\omega < -2$

a. $2\mu < a_0 \leq 3\mu$, and $a_0 > 3\mu$, $\omega \leq \frac{3a_0-5\mu}{\mu-a_0}$

$$\beta > \frac{1}{\sqrt{2}}. \tag{65}$$

b. $a_0 > 3\mu$, $\frac{3a_0-5\mu}{\mu-a_0} < \omega < -2$

$$0 < \beta < \Upsilon \tag{66}$$

where $\Upsilon = \sqrt{\frac{a_0(3+\omega)-\mu(5+\omega)}{2\mu(\omega-2)-2a_0\omega}}$

2. Case $-2 < \omega < -\frac{3}{2}$

$$\Upsilon < \beta < \frac{1}{\sqrt{2}} \tag{67}$$

3. Case $\omega = -\frac{3}{2}$
$\frac{3a_0}{7} < \mu < \frac{a_0}{2}$,

$$0 < \beta < 1 \tag{68}$$

4. Case $\omega > -\frac{3}{2}$
a. $a_0 > \frac{7\mu}{3}$, $-\frac{3}{2} < \omega < \frac{2\mu}{\mu-a_0}$

$$\frac{1}{\sqrt{2}} < \beta < \Upsilon \tag{69}$$

b. $a_0 > \frac{7\mu}{3}$, $\omega \geq \frac{2\mu}{\mu-a_0}$

$$\beta > \frac{1}{\sqrt{2}} \tag{70}$$

On the other hand for the case of Brans wormhole we have:
1. Case $\omega = -2$
a. $B < a_0 \leq 2B, -1 < c < U, 0 < c < V$,

$$0 < \beta < X \tag{71}$$

$$0 < c < V,$$

$$X \leq \beta < \frac{1}{\sqrt{2}} \tag{72}$$

$$-1 < c < 0, c > V,$$

$$\frac{1}{\sqrt{2}} < \beta < 1 \tag{73}$$

b. $a_0 > 2B, -1 < c < 0, U < c < V,$

$$0 < \beta < Y \tag{74}$$

$$-1 < c < 0, 0 < c < V,$$

$$\beta = Y \tag{75}$$

$$-1 < c < U, 0 < c < V,$$

$$Y < \beta < X \tag{76}$$

$$0 < c < V,$$

$$X \leq \beta < \frac{1}{\sqrt{2}} \tag{77}$$

$$-1 < c < 0, c > V,$$

$$\frac{1}{\sqrt{2}} < \beta < 1 \tag{78}$$

where $X = \sqrt{\frac{a_0 - B}{2(3a_0 + B)}}, Y = \sqrt{\frac{a_0 - 2B}{2(5a - 2B)}},$

$$U = \frac{1}{32}\left(-12 + \frac{16a_0(a_0 + 2B)}{B^2} + \frac{1}{\beta^4} + \frac{4}{\beta^2}\right) - \frac{(B - 2(-2a_0 + B)\beta^2)\sqrt{B^2 + 4B(-2a_0 + 3B)\beta^2 + 4(2a_0 + B)(2a_0 + 9B)\beta^4}}{32B^2\beta^4}$$

, and

$$V = \frac{1}{32}\left(-12 + \frac{16a_0(a_0+2B)}{B^2} + \frac{1}{\beta^4} + \frac{4}{\beta^2}\right) + \frac{(B-2(-2a_0+B)\beta^2)\sqrt{B^2+4B(-2a_0+3B)\beta^2+4(2a_0+B)(2a_0+9B)\beta^4}}{32B^2\beta^4}$$

2. Case $\omega = -\frac{3}{2}$
a. $B < a_0 < \frac{5B}{3}, c < -2, -2 < c < 0, c > \frac{-6a_0+4B}{3a_0-5B}$,

$$0 < \beta < 1 \tag{79}$$

b. $a_0 = \frac{5B}{3}, c < -2, -2 < c < 0$,

$$0 < \beta < 1 \tag{80}$$

c. $a_0 > \frac{5B}{3}, \frac{-6a_0+4B}{3a_0-5B} < c < -2, -2 < c < 0$,

$$0 < \beta < 1 \tag{81}$$

3. Case $\omega > -\frac{3}{2}$
a. $c < 0$,

$$0 < \beta < \frac{1}{\sqrt{2}} \tag{82}$$

b. $c > 0$,

$$\frac{1}{\sqrt{2}} < \beta < 1 \tag{83}$$

The interior and exterior regions in this two models are matched at a thin shell made from ordinary matter with positive energy density and pressure. The resulting configuration represents a stable composite wormholes, i.e. the thin matter shell with the Schwarzschild-like exterior region and the interior region containing the wormhole throat. As one can see, "gauge" freedom admits solution that can give origin to wormhole models without an exotic matter and it's property may well change.

6 Summary

In this paper, we have analyzed the stability of a new class of static spherically symmetric configurations composed of interior and exterior Brans-Dicke vacua divided by thin matter shell. Both vacua correspond to the same Brans-Dicke coupling parameter ω, however they are described by the solution with different sets of parameters of integration and arbitrary function $\rho(r)$. In particular, the exterior vacuum solution has $C^- \equiv 0$. In this case the solution with any ω just reduces to the Schwarzschild one being consistent with restrictions on the post-Newtonian parameters following from recent Cassini data. The interior region possesses a strong gravitational field, and so, generally, $C^+ \neq 0$.

The common geometry emerges from the junction conditions at the boundary surface. It must be combined with Darmois-Israel junction conditions. Our approach provides a clear way of showing that the interior and exterior solutions is not a unique static spherically symmetric solution.

An interesting feature of composite wormholes is that the strong-field interior region containing all exotic ghost-like matter is hidden behind the matching surface, whereas the weak-field region out of it possesses the usual Schwarzschild vacuum. Such the configuration is similar to the model of trapped-ghost wormholes [3]. Note that in both presented in this paper models wormholes are twice asymptotically flat. However, in the trapped-ghost wormhole model the ghost is hidden in some restricted region around the throat, whereas in the composite wormhole model the ghost-like Brans-Dicke scalar occupies the "half" of wormhole spacetime behind the matching surface [12]. Anyway, in the composite wormhole configuration a ghost is hidden in the strong-field interior region, which may in principle explain why no ghosts are observed under usual conditions.

Applying the analysis to composite wormhole geometries, considering the one of the Heckmann or Brance solutions as interior region, we deduced stability regions, and found that the latter exist well within the wide range of parameters. We would like to remark, that the Brans-Dicke thin shell wormholes has been mentioned in [15] with a stability analysis. Actually, unlike authors claim in [15], a stability region of Heckmann and Brance composite wormholes can exist with all values of ω.

In this context the idea of linkages for vacuum regions bounding other metrics may have broad applications.

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SOME ANTHROPOLOGY OF HADRONIC SCIENCE AND TECHNOLOGY

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Abstract

Ruggero Maria Santilli initiated and established novel scientific fields of hadronic mathematics, hadronic mechanics and hadronic chemistry, further enriched by various contributions by several other scientists worldwide, e.g. by Vougiouklis in the mathematical field of hyperstructures, Animalu in the field of hadronic superconductivity, and Illert in the field of hadronic biology. Scientific achievements in hadronic mechanics and chemistry unfolded into the novel technology of plasma-arc-flow-recyclers from 1998 onwards, and later into the novel technology of intermediate controlled nuclear fusion without radiations. These hadronic high-technologies claim to represent radical and powerful advances as judged by physical as well as ecological criteria, and are backed not only by patents, but by up-and-working technology and by experimental confirmations from independent investigating bodies. Also, during the last 20+ years there has emerged a vast and growing body of publications with contributions from many scientists word wide working inside various fields of hadronic sciences, becoming opposed or questioned by almost zero scientific publications.

A recent innovation from advances in hadronic mechanics is the invention of the Santilli telescope applying concave lenses, developed with the aim of detecting possible macroscopic objects of antimatter, predicted as existing from the theory of hadronic mechanics, while not possible to detect

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from conventional telescopes applying convex lenses. Such observations were considered outside possibility space of the theoretical horizon of conventional physics such as the theory of Einstein general relativity presented about one century ago. More recently, observations of various classes of antimatter objects have been reported in scientific publications by means of this novel telescope. From dominant scientific communities, following Einstein relativity and not acknowledging the novel scientific paradigm of hadronic mechanics, these possibly highly significant observations have been met with massive neglect.

The present article presents some considerations in order to understand some key mechanisms of this neglect, paying attention to restrictions in the global structuring of memetic information flows from forefront science to specialized scientists and to the laymen, as well as of feedback flows. Such mechanisms may be of special interest because they do not only imply traditional restrictions in paradigms of science, but also restrictions in even more basic world views that make it psychologically difficult to acknowledge strong scientific indications of extra-worldly intelligences being involved in world affairs. The tentative conclusion of the article is that it is hard to imagine fast progress in implementation and growth of sustainable hadronic technologies without occurrence of catalyzing intervention from cultural spheres residing outside science and technology.

Keywords: Santilli; La Violette; hadronic mechanics; hadronic mathematics; hadronic chemistry; hadronic technology; antimatter; isodual light; ITE-1; ITE-2; Santilli telescope; secret space program; UFOs; antigravitation; electrogravitics; Einstein relativity; sustainable industrial processing; anthropology of science; memetic ecology.

Look for Truth, no matter where it takes you.
(David Bohm)

A basic *map* of the memetic ecology of present global science was presented in the study of Johansen (2007) when focusing on the situation for the most *advanced* scientific theories. The study applied a model for emergence and flows of scientific memes in analogy to anthropologist Clifford Geertz' (1963) socio-ecological model for analysis of downhill flows of water in wet rice irrigation cultures. In order to discover and locate *which* scientific theories that competently could be judged as more advanced and hence superior to dominating or previous theory the following six criteria were applied:

(i) emergence of *new technology* not possible from previous theory;

(ii) emergence of *new predictions*, not possible from previous theory, supported by *experimental results*;

(iii) *lifting* of previous theory, resulting in theoretical *broadening*;

(iv) emergence of *novel basic notions and concepts*, relocating basic notions of previous theory to sub-cases;

(v) *compatibility to neighbouring* theories also judged as more superior than dominating theory by application of criteria (i) to (iv);

(vi) *compatibility to overarching* and more abstract principles of formal logic, informatics and strict ontological philosophy.

These six criteria represent criteria *inherent* to science itself as an intellectual pursuit. In this sense they are of *substantivistic* quality, thus contrasted to *formalistic* evaluations applying criteria *external* to science itself such as what scientific theory that at present is most popular, most quoted, or most backed by money, power and authority positions inside and outside scientific communities.

Application of these six criteria resulted in the following selection of superior scientific grand theories:

(i) *hadronic mechanics*, chemistry, biology and mathematics, initiated by R.M. Santilli;

(ii) *nilpotent universal computational rewrite system*, initiated by P. Rowlands;

(iii) *global scaling theory*, initiated by H. Müller;

(iv) *causal mechanics*, initiated by N. Kozyrev;

(v) *topological geometrodynamics*, initiated by M. Pitkänen.

Despite theoretical differences between these five "grand theories", the article argued much compatibility between said theories, so that these five theories constituted some avant-garde *clustering* of superior scientific memes as compared to previous and competing theories. Among these theories the article argued hadronic mechanics to represent the most obviously superior among grand theories when applying the six criteria, and thus as the *basic platform* "from which to discover the most advanced meme clusters in the global ecosystem of science, for judging the scientific level of other theories, and to construct an adequate standard for judging the reality status of strange phenomena" (Johansen 2007: 56).

With respect to the overall picture the situation today is not radically different from of 2007, despite that emergence of a few more recent theories supplement the avant-garde clustering of 2007. Since 2007 hadronic mechanics has continued to progress theoretically, and has achieved further significant technological breakthroughs with related industrial implementation. Thus, the outstanding positioning of hadronic mechanics among superior grand theories does not appear less clear today than in 2007 when applying the six criteria.

In the present publication context it leads too far to analyze in general these more recent developments and their updated relations to present extra-scientific constraints for irrigation of advanced science in the global science ecology. Instead we will focus one single and quite extraordinary case that may be of special interest in order to enlighten more general issues at hand, namely the recent publications announcing the discovery of *Invisible Terrestrial Entities* (ITE) by means of hadronic mechanics and the novel *Santilli telescope*.

In hadronic mechanics matter and antimatter occur at an *equal* ontological footing, and the same holds for related opposing quantities such as positive energy vs. negative energy in the universe as a whole. In this larger ontological framework which includes antimatter, positive and negative quantities in the universe cancel out to *zero*. (Somewhat complementary, *nilpotency* is a key concept in Rowlands' (2007) grand theory.) Consistent with

this "scientific democracy" (Santilli) between matter and antimatter, hadronic mechanics did predict discovery of antimatter bodies also at the *classical* level, i.e. not only at the operator level of quantum mechanics. For such possible detection the Santilli telescope became developed as a logical complement to the conventional Galileo telescope. While the Galileo telescope applies a convex lens in order to focus and detect conventional light originating from matter, the Santilli telescope applies a concave lens in order to focus and detect light originating from antimatter, coined *antimatter light*. By means of the Santilli telescope observations of possible or likely antimatter *galaxies* (in the region of first Vega and later Capella) became indicated by Santilli (2014) and next given confirming support by Bhujbal et al. (2014) and Beghella-Burtoli et al. (2015). With respect to observation of antimatter *cosmic rays* and *asteorids* these became suggested by Santilli (2014) and next given confirming support by Beghella-Burtoli et al. (2015).

These observations, consistent with predictions from hadronic mechanics, provided interesting support to hadronic mechanics in general since such observations are not consistent with conventional and dominating theories of physics where antimatter does *not* occur at the classical level. So far later observational results in *disagreement* with these publications have not been published. Nor has any scientific publication disputing the theoretical *interpretation* of the published observations seen its day. The overwhelming response from physicists and astrophysicists working outside hadronic mechanics has so far been *silence*, i.e. neglect.

Next, even more surprisingly, and initially unintended, observations of objects *in our terrestrial environment* by means of the Santilli telescope, not visible by conventional convex telescopes nor by the convex lenses of our eyes, became published in Santilli (2016a). 'Terrestrial environment' is here "defined as including our atmosphere, terrestrial and lunar orbits and under the sea" (Santilli 2016a:47). Antimatter light is also named *isodual light*, consistent with the general twin like architecture of hadronic mechanics where the "democratic" duality of matter and antimatter is congruent with a corresponding twin like duality in the architecture of hadronic mathematics. Isodual concepts, fields and quantities, such as e.g. isodual numbers and isodual spacetimes,

occur in this theory as twin like extensions when compared to conventional theories of physics and their related mathematics. Further, the architecture of hadronic mechanics and related mathematics is even more radically extended as compared to conventional theories because three more complex theoretical and ontological *levels* are added into the theory, namely of isofields, genofields and hyperfields, where each of these levels have their corresponding isodual.

The very notion of antimatter light may seem rather mysterious from most theories of physics outside hadronic mechanics. However, from the perspective of hadronic mechanics the notion of isodual light, in distinction to all conventional (matter) light, is not only *consistent* with the general architecture of this theory of physics, but a *necessary* implication of said architecture. Antimatter light may seem more demystified by contrasting its *negative* refraction index, when propagating in a matter medium, to the *positive* refraction index of matter light propagating in the same medium. One implication of this contrast is that while the velocity of matter light will be reduced by undergoing refraction in a denser matter medium as e.g. water, the velocity of antimatter light will be increased when undergoing refraction in the same matter medium. Thus, existence of antimatter light implicates possible velocities far above the speed of light in vacuum. Since Einstein's theory of relativity does not include any physics of (macroscopic) antimatter, the theory of Einstein, regarded from hadronic mechanics, is too narrow in its foundations to account for and calculate the range of possible speeds in the universe.

Santilli (2016a:52) distinguishes between two kinds of invisible terrestrial entities in our terrestrial environment: *ITE-1* and *ITE-2*, indicated, respectively, by *dark* vs. *bright* areas as observed at a computer screen connected to the Santilli telescope. *Antimatter light* must be emitted from both kinds of objects in order for them to appear invisible to our eyes as well as to conventional telescopes, while they do appear visible by the Santilli telescope. At the same time both kinds have been observed as located inside our matter atmosphere, thus as not being annihilated from entering our atmosphere. Therefore, both kinds must be made up of matter, not of antimatter, despite emitting antimatter light which has a *negative refraction index* when propagating in the matter medium of our atmosphere. The two kinds are

interpreted and distinguished by ITE-1 carrying *negative energy* vs. ITE-2 carrying *positive energy*. The two kinds can be explained by emission of antimatter light by two different mechanisms, either "as a form of *exhaust* (ITE-1), or via *engineering* means capable of inverting the index of refraction of ordinary light (ITE-2)" (Santilli 2016a:52).

ITE objects have been reported observed not only in stationary states, but also as obviously *moving* (visible only by the Santilli telescope), and in some cases paralleled by movements of objects *in and out* ("blinking") of the field of vision available to the convex lenses of our eyes and conventional telescopes. "Their locomotion appears to be based on the *internal presence of antimatter* and the use of matter-antimatter repulsion" (ibid.; my emphasis). Interestingly, this is consistent with the theory in mathematical physics presented by Santilli (2006: ch. 4) which thus seems to represent a rather privileged theory in order to scientifically approach the complexities involved in ITE movements.

(In recent interviews Santilli (2016b, 2016c) has also stated the existence of a less radical and complex kind, *ITE-3*, characterized by manipulation of the frequency of matter light, but without changing the sign of the refraction index between positive and negative. Also such manipulation can make an object in space invisible ("stealth condition") for the frequency span covered by ordinary vision. Santilli (2016b: 1:27:30) reports to have performed experiments successful in manipulation of the frequencies of laser light, and thus provided experimental evidence consistent with existence of ITE-3 in agreement with predictions from hadronic mechanics.)

Also these recent publications of ITE observations, despite their amazing nature and possible significance for science, as well as for the world at large, have so far overwhelmingly been met with silence and neglect from scientists working in theoretical physics and astrophysics outside hadronic mechanics, not with enthusiasm, curiosity or eager critical investigation by repeated or novel experiments and upgraded theoretical reasoning.

However, some publications by the theoretical physicist and astrophysicist *Paul LaViolette* appear highly relevant with respect to the recent discoveries of ITEs from hadronic mechanics and related technology.

LaViolette (1994) presented an ambitious work in *subquantum kinetics* which focused on possible theoretical mechanisms to explain *relations* between micro-physical entities residing at the implicated ontological level of the subquantum (vacuum / plenum / ether / zeropoint/ universal substratum) and thus residing outside and above the ontological level of (conventional) elementary particles. The theory of LaViolette represented some aspects of heretics, arguing laws of thermodynamics not to be generally valid (that is, in their present formulation) when *including* subquantum kinetics, as well as arguing crucial restrictions in Einstein's general theory of relativity (GR). Further, LaViolette claimed basic achievement of a unified grand theory from establishing *electrogravitics* as a qualified key concept in his theory. More recently, LaViolette (2015: 50:55) claims twelve predictions of "salient points" from his theory to have become supported by proceeding observations or experiments.

To my knowledge LaViolette has not published direct references to theory, technology or experiments from hadronic mechanics. Viewed in the opposite direction, the significance of the universal substratum, or ether, in various theoretical contexts has often been emphasized by Santilli, and Santilli has announced the significance of upcoming theoretical efforts stretching into subquantum physics. More specifically, Santilli (2007) has argued the theoretically necessary addition of a micro-physical entity residing in the ether, coined the *etherino*, in order to account for the missing energy of 0,78 MeV and of spin ½ required for synthesis of one neutron from one proton and one electron.

(On the one hand the etherino as such is not possible to observe in our physical 3D world, and thus it does not represent an elementary particle in the conventional sense and may be viewed as a quasi-particle. On the other hand energy from the etherino manifests into our physical 3D world through some interaction between the etherino in the ether and elementary particles. Hence, we may classify the etherino as a *meta-particle*, connoting 'meta' to 'before', as Aristotle did, not only to ontologically 'above'. In the words of Santilli (2007:682): "The etherino is not intended to be a conventional particle, but an entity representing the transfer of the missing quantities from the environment or the ether to the neutron.")

Further, Ahmar et al. (2013:321), who reported "additional experimental confirmation of Santilli's IsoRedShift", referred directly to the study of LaViolette (1986), compatible with Zwicky's hypothesis of "tired light", in their selection of previous science considered forerunning Santilli's presentation of a novel theory from hadronic mechanics in order to explain the redshift (and blueshift).

In 2008 LaViolette published the book *Secrets of Antigravity Propulsion: Tesla, UFOs, and Classified Aerospace Technology*. The book carefully tracks certain likely key elements in development of antigravity technology after World War II, from information available in open sources, along with related underlying theory of new physics. Special emphasis is given to document the significance of the work of T. Townsend Brown for research and development of antigravity theory and technology in military and industry, with Brown himself holding key positions in the projects. One was *Project Skyvault* (LaViolette 2008: ch.7; LaViolette 2015: 1:07) established already in the late1940s, by Rocketydine Corp. This project developed technology that lofted crafts on microwave energy beams. Masers and phase conjugate resonators were used to create the beams. Instead of sinus waves saw tooth shaped forms of microwaves were applied, and metamaterials with negative refractive index were applied in order to increase the thrust. Another project involving Brown in a key position was *Project Winterhaven* established in 1953. A third, from 1955-56, was *Project Montgolfier*, established in Paris, not becoming disclosed before 2008 (!). In 1954-56 no less than 19 companies (specified in LaViolette 2015: 1:07) were involved in R&D manifesting in a confidential book named *Electrogravitics Systems*, printed by *Aviation Studies (international) Ltd.* (1956) by and for selected scientists and engineers inside these 19 companies in Feb 1956, to become declassified not before around year 2000 (LaViolette 2008:appendix; LaViolette 2015: 1:05). With respect to these technologies and projects, see also Valone (1994, 2015).

The documentation provided by LaViolette is rather compelling. Further support is given by LaViolette (2015) himself reporting to have been able to *reverse engineer* some key elements of antigravity technology from segments of said documentation. The picture that emerges is that fundamental advances

in antigravity technology, based on theories of physics beyond Einstein, may very well have been a clandestine *fait accompli* already from the late 1940s on.

This is a big bite to swallow for most physicists working inside the restrictions of the Einstein paradigm. However, from antigravity theory of hadronic mechanics, consistent with recent experiments and observations by means of the Santilli telescope, this picture does not appear *that* strange and surprising when being regarded from solely a scientific point of view. Viewed from this angle the surprise is rather that so much antigravity technology seems to have been possible to develop that early on even *without* the rigorous and extensive theoretical body of today's hadronic mechanics.

Interestingly aligned with a key notion in the novel theory of mathematical physics presented in chapter 4, "Antigravity and spacetime machines", in the book by Santilli (2006: 253-288), also LaViolette (2015: 11) refers to a principle of *reactionless* propulsion in contrast to Newton's third law. Similar to Santilli's notion of the etherino LaViolette (2015: 24) refers to "etheron transmutation". Consistent with Santilli's notion of ITE-3 and involved cloaking technology, LaViolette (2008:31) refers to cloaking technology as an achieved fact at least at 1994, and to the related significance of frequency manipulation in order to achieve the stealth condition (LaViolette 2015: 1:22). Far from being any notion of science fiction, some among todays' *metamaterials* (cf. Wikipedia) have a negative index of refraction. The *Boeing cube* of 2003 represents one such metamaterial being produced by microwaves (LaViolette 2015: 1:22).

This scenario implicates radical new estimations of space travel within reach, as compared to from Einstein GR and conventional rocket and space ship technology *not* based on reactionless propulsion. As illustration LaViolette (2015) presents a few calculations: 5 days for space travel to Mars when applying Brown technology (ibid.: 1); and 21 days (instead of 16 months) for space travel to Jupiter when applying Nassika's superconductive thruster (ibid.: 30). By technology reported developed by LaViolette himself (achieving velocities up to 6,5 times *c* in experiments), Alpha Centauri, 4,37 light years away, can be reached in 2,5 months (ibid.: 1:24). However, this will require

tremendous energy (4 billion terajoules). Scaling down to 1,7 million terajoules, Alpha Centauri can be reached in 5 years (ibid.: 1:24).

To what extent may space travel applying clandestine antigravity technology already have become realized? In 2008 LaViolette wrote:

It is apparent that there has been an effort to keep secret the military's capabilities in space. While NASA was mesmerizing the public with its rocket flights, aerospace companies were carrying out secret research on electrogravitics and microwave beam propulsion technologies. A good guess is that the U.S. military currently has large fleets of craft capable of hypersonic flight in space that use non-conventional means of propulsion...It seems the United States has ongoing, manned space operations that go beyond anyone's wildest dreams, all taking place under a cloak of secrecy and all made possible by advanced field-effect propulsion technologies that were under intense development in the middle of the twentieth century. (LaViolette 2008:2)

Ben Rich (1925-1995) was director of Lockheed Skunk Works 1975-1991, and has been reported from some sources close to him to have been given statements providing at least some circumstantial support to LaViolette's picture, such as: "We already have the means to travel among the stars, but these technologies are locked up in black projects, and it would take an act of God to ever get them out to benefit humanity. Anything you can imagine, we already know how to do" (cf. Wickersham 2014).

Also, one should pay attention to statements by Santilli in the same direction, such as:

Research now going on in the military, e.g. at Sandia Laboratories, are immensely more advanced than those going on at Harvard, MIT, Princeton and similar places, trivially, because the former were unobstructed by scientific politics, while the latter have been severely constrained. (Santilli 2000)

With respect to the present over-all situation LaViolette portrays a picture that deviates radically from the conception of far most scientists, as well as laymen. He claims that from unconventional ether physics and related antigravity technology even off-planet *civilizations* may have become secretly established, funded by black budgets. He further claims these ongoing endeavors, applying technology radically more advanced and different from

"earthbound petrol-guzzling polluting technologies: rockets, jets, automobiles, trains" to be of "no direct benefit to Earth civilization" (LaViolette 2015: 1:22).

The claim about the existence of a successful secret space program, applying physics and technology beyond Einstein, has more recently been given increasing support from various other sources which claim access to inside information and in some cases (as William Tompkins) also to have participated in secret space programs themselves. Generally speaking, these sources have not been able to back their claims with much hard evidence. To some extent this shortcoming may be reasonable due to the sensitivity of the involved issues. At least these sources taken together may be looked at as a growing body of circumstantial evidence, and the same with respect to the establishment of public conferences about the secret space program, the first held in 2011. The idea about possible long time existence of a secret space program is disseminated to a broader public also by popular writers as e.g. David Wilcock who claims access to consistent testimonies from real insiders. Another source, not much known but quite intriguing, is the material written by the mysterious A.R. Bordon (pseudonym), the former key scientist of the *Life Physics Group* (I). This material contains some original development of scientific theory, much inspired by Bohm's physics and ontology, relevant for establishing and understanding interaction with groups of aliens. The material also includes analysis and reports from such claimed interactions, including face-to-face encounters and scheduled meetings (cf. the book by Bordon 2007). Whatever the degree of truth in the material, some of it (e.g. Bordon 2004 and Bordon 2006) appears sophisticated by scientific standards. This part of the material is not likely to be faked, since one hardly can present fake theory that is more advanced in its intellectual structure than the truthful reasoning of the author himself.

Concerning the issue of "disclosure", it may be useful to first consider serious disclosures that de facto *already* have taken place, whatever low key. One such is the two step declassification in 2004 and 2011 of some articles from *NSA Technical Journal*, where the two articles by Campaigne (1966, 1969) are of special interest. Campaigne wrote: "Recently a series of radio messages was heard coming from outer space" (1966:101), referring to

messages published in the same journal by Callimamos (1966). Three years later Campaigne (1969) presented his achievement of the "key to the extraterrestrial messages" in a detailed technical analysis that decrypted most of said messages. At the end of his analysis Campaigne wrote: "The concepts used here are the basic ones of number, sets, and physical constants which any cultures must share" (ibid.:23). Webber (2013a, 2013b) presents an interesting discussion of these declassified articles, as well as some further decryption, concluding that it is highly unlikely that these messages were not authentic.

In certain private contexts some scientists may claim personal experience from encounters, more or less close, with alien intelligence or individuals, while very few of these scientists will speak or write about such encounters in more public contexts as e.g. J. Sarfatti has done. Much due to fear of negative sanctions concerning their reputation as being serious scientists, it is understandable that such scientists hesitate to go public with their experiences, especially if their scientific standing already is high. Thus, the number of scientists who conceive having had such experiences is likely to be significantly larger than the public are aware. Recently, Santilli (2016b,2016c) has exhibited the courage to go public with his close encounter in mountains of Italy in 1982, experienced together with his family. The observed bright and moving object did not emit sound, only light, and induced significant deformations in the appearance of stars. This indicated that the object applied tremendous amounts of energy, which makes it highly unlikely that the phenomenon manifested from technology with a human source. The complexity of the involved technology was further indicated by some report of missing time, a phenomenon that may require sophisticated interfacing to the human mind/brain. Most scientists will find it hard to believe the authenticity of such a scenario, due to paradigmatic restrictions in their theories which make it impossible to explain crucial aspects of the experience from solid *physics*. However, when approached from the deeper theory of hadronic mechanics, providing a much broader horizon for the range of natural phenomena, said aspects do *not* fall outside the possibility space of theoretical physics. To the contrary, such extraordinary phenomena (e.g. the deformation of stars) are of *special* interest to *evaluate* the validity and possible superiority of hadronic

mechanics (or other forefront theory) compared to conventional theory of physics. Such phenomena, especially when they are experienced by the scientist himself, may also show crucial in order to catalyze development into *further* superiority of the theory.

There is no such thing as a paranormal phenomenon *per se*; what phenomena that are to be classified as "paranormal" depend on the implicated scientific standard to *judge* a phenomenon as normal vs. paranormal. The more advanced a theory becomes a broader range of phenomena can be reclassified from paranormal to normal. When the amount of observations of a certain phenomenon, say of UFOs or of advanced crop circles, reaches a critical threshold, continued insistence of the phenomenon being "paranormal" does not suggest a scientific attitude, but a rather urgent need for science to radically advance the basis of its theory in order to broaden the range of phenomena explainable from theory. (See Johansen 2007 for more extensive discussion and clarification of this topic.)

If we look into the case of advanced "crop circles", in some cases vast and complex crop formations have been filmed by eye witnesses while the formations have been made, displaying the whole operation to take less than one minute and happening in parallel with objects looking as plasma orbs flying above the acre. It is somewhat embarrassing that this rather spectacular phenomenon remains overwhelmingly neglected by scientific publications as judged from open sources. The foremost exception is two booklets by Pitkänen (2006a, 2006b) which presented, inside the framework of his grand theory (cf. Pitkänen I and 2016), a sophisticated and extensive analysis of the crop circle phenomenon with detailed investigation of two famous crop circles: Chilbolton and Crabwood. His analysis provided serious and advanced discussion of possibly involved *technology* and possible *location(s)* in spacetime of the creators, as well as of the *genomic* make-up of the creators as indicated by messages coded in the circles. Crucial aspects of his analysis required concepts and notions of mathematical physics (and related genetics) *exclusively* developed inside the huge theory building of Pitkänen's topological geometrodynamics. Consequently, the conclusions and suggestions from Pitkänen's analyses would not be *possible* to reach from conventional

theoretical physics. Thus his own *general* avant-garde theory constituted a necessary condition to *transform* the "paranormal" phenomenon at hand into a phenomenon accessible for thorough scientific explanation. Whatever possible shortcomings in Pitkänen's analyses, this is the way ambitious science should behave when confronting an intriguing phenomenon of possible high significance.

The overall picture is that paradigmatic clinging to Einstein's GR as *dogma* has worked in tandem with massive "scientific" *denial* of several extraordinary phenomena, despite that some among such phenomena have become reported at an increasing rate and with possible high importance for the world at large. Denial, as analyzed by Freud, represents one of the classic defense mechanisms operating in the human psyche. Denial tends not to diminish, but to increase and turn more irrationally aggressive when being confronted with a growing amount of threatening facts, until it reaches a critical threshold where it starts imploding. Kuhn (1962) describes much of the same pattern with respect to denial and neglect of anomalies in the paradigm of normal science, until the amount of anomalies grows to a point where a scientific revolution into an alternative and more advanced paradigm can take place. However, both in normal human affairs and inside scientific communities, denial typically will not dissolve as an autonomous, isolated process inside one person or one (sub) community, but as result of pressure from and conflict with outsiders who are *not* in denial.

This is – of course – not the context for detailed and demanding discussion of scientific insights vs. restrictions represented by Einstein GR. Einstein himself was not that satisfied with his own theory, as e.g. indicated by his somewhat ambivalent attitude towards bringing the ether into the general theory, and his struggle to integrate certain key points from the Kaluza-Klein modification. Whatever the elements of more lasting scientific merit in GR, our point in this context is the inoptimalities of a *dogmatic* attitude regarding GR as some basically *final* theoretical truth about the macrocosmos, unwilling to critically *investigate* possible superior merits by more recent avant-garde theories of physics with related paradigms that more or less surmounts or conflicts with GR.

As *one* extraordinary phenomenon *not consistent* with Einstein's GR (at least according to standard and most common interpretations of GR), let us restrict our view to the case of *'UFOs'* in the common sense, i.e. observations of objects in our terrestrial environment that move in manners that appear as intentional by means of technology much more advanced than air planes, satellites and well-known human spaceships. Among such extraordinary movements may be extremely high speeds and sharp turns, sudden quick movements upwards, radical morphing in the shape of the object, bifurcation into mothership vs. daughter ships, and alternations in and out of our 3D field of vision. When the movement seems sufficiently advanced to presuppose antigravity propulsion, this will be considered beyond Einstein and thus as physically impossible by most GR followers. Consequently, observations of such movements have to be explained (away) by some kind of optical illusion due to a seducing exterior source of a "natural" phenomenon and/or due to a seducing interior source of anomalous brain activity. The ultimate limit for considering *alien* UFOs as real will be the conception of Einstein GR as having proved that velocities above the speed of light in vacuum are physically impossible. When ignoring the possibility of aliens residing inside our own solar system, this rules out the possibility of visitations from alien civilizations since such space travel would take much too long time to be considered realistic.

Thus, from the *dominating* theory of physics inside scientific communities of physics, as well as the subfield of astrophysics, taking GR as established truth, such UFOs *cannot* exist. The dominance of GR is indicated by *formalistic* criteria such as the number of physicists following GR who hold authority positions in science, their number of publications, the number of quotations to said publications, and the number of scientific results becoming presented by the rather oligopolistic constellation of the journals *Nature, Scientific American, Science* and *New Scientist* which function much as middle men *gatekeepers* for dissemination of claimed advances in science into specialized scientists and main stream media. From this formalistic dominance, most people, inside as well as outside most scientific communities, not being capable to evaluate the truth of the issue from *substantial* scientific competence

and autonomous investigation, will think that the dominating theory of physics really *is* the most advanced theory of physics. This belief may be underpinned by some *general* trust in societal authorities. Even if not much so, the belief will be reinforced by the widespread conception of the scientific discipline of mathematical physics to be close to neutral in its approach to truth, at least with regard to the overwhelming majority of scientists working in the field, and as a high IQ endeavor almost as trustworthy as pure mathematics.

By this trust in formalistic criteria, rooted in *psychological* mechanisms, the Einstein GR dogma dominating theoretical physics becomes *duplicated* in a corresponding dogma among most persons outside physics. When UFOs are announced as superstition from dominating physics due to violating the Einstein GR dogma, most persons will consider UFOs as superstition when attempting to preserve a mindset they can self-regard and present as aligned with the most intelligent and competent position of *science*.

The quite international movement of so-called *skeptics* is interesting as a tell-tale sign of the *strength* in this psychological duplication of memes from dominating theoretical physics into dominating memes in the meme pool of humans working outside theoretical physics. With exceptions from the rule, self-named skeptics do not possess much substantial scientific competence in the GR paradigm dominating mathematical physics, and very much less so in more recent, competing paradigms involving more complex ontologies of the cosmos as well as novel key notions and radical extensions of mathematics. In spite of such shortcomings in relevant basic and substantial scientific competence, "skeptics" *feel* motivated and competent to judge novel paradigms of mathematical physics to be inferior to Einstein GR. Rather obviously, this motivation for clinging to GR dogma is more fueled by *psychological* currents than by sober scientific investigation and evaluation.

The Greek term 'skeptic' means examination, inquiry, consideration. In order to investigate a claimed avant-garde theory of science, point one is to recognize *what* is to *become* investigated, which requires that you first *open* your mind, as much as you are able, into a psychologically challenging new paradigm, and next try to *educate* yourself *into* and *inside* the new paradigm of mathematical physics. First *thereafter* you can step out and up to a possible

position of more adequate *evaluation* of the radical novel theory as compared to the conventional one.

In the discipline of anthropology, attempting to understand and analyze cultural systems of "the others", however strange and alien they may seem from your own cultural system and horizon, the first step is to attempt, as much as you are able, to put your own cultural prejudices, categories and horizons in *brackets*. These others should be understood in and by their *own* terms, on their own premises, inside the more or less self-referential *wholeness* of their cultural system. Preferably this is attempted by the method of *participating observation* inside their culture (denoted *field work*), i.e. by the anthropologist trying to "go bush", as much as (s)he is able to, for a while. By building up participating competence and gradual immersion towards the wholeness of the alien culture, the anthropologist strives to achieve the *same* understanding of the alien knowledge system and its related cultural values as the others themselves. This is called *emic* understanding of the alien culture.

Next step, *after* having achieved access to crucial emic knowledge, is to attempt to *analyze* this particular cultural system from a deeper and broader, and thus more *universal*, theory of anthropology where the anthropologist's own culture, as well as the culture (s)he studies, only manifests as sub-cases from variations in deeper variables. Such analytical understanding of the alien culture by means of universal concepts and models of anthropology, is called *ethic* understanding of the alien culture. (In this disciplinary context the term 'ethic' is considered morally neutral and merely addresses the requirement and application of a more universal theory in order to *place* and *explain* the alien culture as it is conceived in the anthropologist's emic understanding.)

The discipline of anthropology does not qualify (at least at present) as *hard* science, much due to the obvious fact that the *object* of anthropology, involving human minds and their interactive actions, are much more complex than the objects of (far most) mathematical physics. Still though, anthropology's two-step approach of first emic and next ethic understanding has shown to be crucial for fruitful studies of even highly exotic cultures. Thus, there must be some *general* wisdom in this approach, implying that this two-step approach is fruitful also in dealing with *segments* of a culture that is not

that exotic, such as alternative theories and paradigms of theoretical physics inside the culture(s) of modern scientific communities.

Judged from the classic methodology of anthropology, the approaches to avant-garde theoretical physics from "skeptics" are involves shortcomings because of (i) extreme lack of *emic* understanding of these theories due to lack of required scientific skills or efforts; and (ii) lack of *ethic* and more universal *metatheory* to place and evaluate these emic theories of (claimed) more advanced theories of mathematical physics, with related ontologies and key categories, as compared to the dominating emic paradigm of Einstein GR. (The six criteria in our introduction represent elements of such metatheory.) Due to these shortcomings, we prefer to apply the term 'para-skeptics'.

Most efforts from para-skeptics, eager to quickly "debunk" complex avant-garde theories of science, appear amazingly far from an *emic* understanding of said theories. This is understandable when an alternative theory appears as somewhat strange and exotic as viewed from the conventional paradigm, but it does not represent a serious approach. A fruitful approach should enter an alternative theory from the epistemological "principle of charity" which is congruent with the first step in the anthropological approach. In general there is a striking contradiction when para-skeptics on the one hand *claim* to protect solid scientific standards, and on the other hand seem to be crucially fueled by clinging to scientific *dogma*, in casu Einstein GR, *without* having motivation or skills to carefully *investigate* theoretical issues at hand. The paradoxical result is that para-skeptics tend to appear more like propagandists of dogmas from the Catholic church than as *real* skeptics in the Greek meaning of the word.

Next, the stated duplicating effect into more or less layman memes, functions with some reinforcing *feedback* effect into scientific communities. Thus, scientists becoming doubtful about the truth of the Einstein GR dogma, and/or puzzled by UFO observations, and inclined towards investigating these theoretical and empirical issues, might become obstructed from executing such exploration, and even more to utter their thoughts in public, due to fear from becoming sanctioned by ridicule from power positions hold by strong layman

memes, such as those promoted quite aggressively by the movement of para-skeptics.

(One informative similar case is the continued obstruction of most significant information related to achievements in hadronic mechanics and technology at the influential site of *Wikipedia*. For example, the Wikipedia entry on 'Ruggero Santilli' is still far from having achieved minimalistic accuracy, relevant introduction and broad overview, both as judged from criteria of science itself and from criteria of sober encyclopedia editing targeting a wider audience without scientific expertise in these vast, complex and scientifically revolutionary fields. To the extent that such shortcomings are intended by antagonists of hadronic science and technology, an obvious motivation is to discourage not only laymen, but also scientists, from serious inquiries into these intellectually challenging fields.)

Denial of the UFO phenomenon becomes rather ironic if acknowledging quite compelling evidence that *human* technology, for the most part connected to secret space programs, has been able to construct antigravity crafts for some 60+ years. Also, to claim that UFO observations *must* be illusions because they conflict with Einstein GR, does not reflect any well-informed and updated overview of theoretical physics, when recognizing that Santilli (1994) already in 1994 presented an article for the MUFON community, announcing and clarifying the scientific novelty that locomotion of antigravity spacetime machines *was* explainable from theoretical physics in the form of hadronic mechanics.

From reasonably updated *scientific* information about the state of the art of empirical UFO observations and about more advanced theories of physics attempting to surmount Einstein GR in order to adequately explain such observations, the empirical fact of UFOs being for real and explainable by advanced science, should be beyond serious doubt. A more difficult scientific challenge, though, is to adequately and more exactly draw the line between *manmade* UFOs and UFOs of *alien* origin. Analogous difficulties arise with respect to drawing the line between human vs. alien origin of various other extraordinary, but significant, empirical phenomena requiring advanced technology and underpinning science, such as advanced crop circles, certain

nanotechnological exposures, wireless mind/brain manipulation, alien vs. Milab abductions, etc. A further difficulty is represented by the possibility of some cooperation, in various respects, between some segments of humans and aliens, and even more if bringing in the possibility of created human-alien hybrids by means of advanced genetic technology. The whole picture is too vast and complex to become discussed in the present context. Whatever involved and challenging difficulties, the goal of really advanced – and brave – science should be, in principal, to address and explore these issues.

The so-called disclosure movement, as represented by Steven Greer, has called for disclosure much in order for humanity to take advantage of zeropoint/ "free" *energy technology*, with related underpinning science, considered to be involved in propulsion of *alien* UFOs. This motivation seems either scientifically uninformed or as a dysfunctional, intended distraction, since there by now exists (i) rather compelling evidence for such more advanced energy technology having been around as a *human* (re-)invention implemented in secret space programs for 60+ years; and (ii) invented and implemented ecofriendly *hadronic* energy technologies, available *outside* clandestine projects, steadily advancing in efficiency and potency for almost 20 years. The direction of the disclosure movement in the energy issue seems rather paradoxical, when giving *first* priority to disclosure of alien energy technology, *second* priority to disclosure of secret human energy technology adopted from alien technology (*if* they believe this human technology to exist at all); and *zero* priority to focusing and application of powerful and ecofriendly human energy technology that is *not* secret and undeniably *does* exist. Why beg political authorities for possible access to assumed super-advanced *alien* energy technology, somewhere into the future, motivated by reasons of 'sustainability', instead of focusing on the sufficiently advanced and sustainable hadronic technology available on Earth here and now?

In contrast to the disclosure movement we have the broad part of scientists holding a belief set that eliminates the possibility of alien UFOs as well as human UFOs, much because of dogmatic belief in Einstein GR, while also because such a possibility leads to disturbing and headache inducing questions about the more general legitimacy of various authority structures in

our world. For these scientists, as well as laymen holding similar belief sets, scientific and technological progress towards radically increased sustainability seems as a very difficult endeavor that will take long time and effort and which is not likely to become successful other than as a result of many small steps. For such scientists the de facto existence of powerful and sustainable hadronic technologies seems too good to be true, and even more so when they are based on theoretical physics and chemistry beyond Einstein GR and conventional quantum mechanics. Hence, such scientists, and aligned laymen, will tend to ignore or oppose hadronic sustainable technology for reasons of *belief* more than of science itself.

Thus, when seeking for sustainable scientific and technological progress, we have a curious constellation of two poles: At one pole we have those looking *too much up in the sky*, asking for development aid from aliens via middle men of political authorities considered to be in the know and in position, to become realized when some critical event of disclosure finally takes place after growing public pressure and expectation. At the other pole we have those looking *too much down to the ground*, focusing on achieving "the green shift" by many small steps that gradually improve energy technology originating from the sun, ocean waves, wind mills etc., without surmounting the century old paradigms of GR and conventional quantum mechanics.

Interestingly, *both* poles lead to ignorance and impotence with respect to implementation and further R&D of the *existing* sustainable and ecologically powerful technologies manifesting from the advances of hadronic mechanics. Also, the attitude of *both* poles are grounded in *beliefs*; respectively concerning political authorities' relation to aliens, and concerning the eternal validity of Einstein GR – not in *scientific knowledge* of the most advanced grand theories of science today, despite that far-reaching theoretical advances in the case of hadronic mechanics already have manifested into novel, powerful and ecofriendly technologies. Further, it follows from *both* poles that successful development of sustainable energy technology appears *uncertain* and may take a very *long time*. Thus, *both* poles are in fundamental *denial* of the most important circumstance with respect to the issue of sustainability, which is that global sustainability is a realistic scientific achievement in a very *near* future if

– and perhaps only if – sufficient resources become allocated to increased R&D of hadronic technologies and underpinning "new era" scientific theory, with related upscaling in implementation of these technologies. Thus, the obstacles for achieving global sustainability are hardly obstacles residing *inside* science as a *substantivistic* pursuit, but obstacles of *extra-scientific* nature, residing in key elements of more or less powerful *belief systems* clinging to non-adequate *formalistic* criteria in order to judge what is advanced science of theoretical physics with related technology.

One century ago, the break-throughs by quantum mechanics and by Einstein did not become much acknowledged by the "broader" scientific communities and higher formal authorities before around one decade after the theoretical achievements were published. The present world-wide situation is much more paradoxical and delayed by non-rational factors with respect to acknowledging significant break-throughs in mathematical physics. The first and initiating hadronic *technology*, presupposing the achievements and predictions of hadronic mechanics in theoretical physics and chemistry, was up and running already back in December 1998, i.e. almost twenty years ago! This novel and rather spectacular technology was not explainable and not regarded possible by conventional theories of physics and chemistry. After 1998 plural novel, powerful and ecofriendly technologies have become invented and more or less implemented, from *further* R&D by hadronic mechanics, with Santilli himself as the main innovator. Still, far most theoretical physicists and chemists pretend *as if* these technologies are *not* existing, up-and-going and gradually becoming more refined and implemented, due to the psychological simplistic reason that these technologies invalidates their basic *belief sets* clinging to dogmas of conventional theoretical physics and quantum chemistry. Judged from the perspective of history of science, this denial or neglect of highly significant *positivistic facts* of hard technology presupposing and innovated from advances in hadronic mechanics, with related mathematics and chemistry, *successfully* surmounting the belief sets of previous paradigms of Einstein GR and quantum chemistry, seems rather surrealistic if taken only for face value.

From these reflections, connected to state-of-the-art of some highly potent avant-garde science, we may step episto-ontologically upwards to a more

general approach towards an attempted universal-ethical anthropology of science.

From the general irrigation model for mapping the global ecosystem of scientific memes presented in Johansen (2007), there were listed *six kinds* of possible *systemic restrictions* imposed on creation and flow of advanced scientific memes:

1) New and more advanced memetic species are *not created.*

2) Advanced memetic seeds are not positioned at or *not transported to the top* of the global knowledge "mountain" interpreted as a social hierarchical structuring of memetic flows in the global ecology of scientific memes.

3) Advanced memes are put into the memetic "water" only to a privileged vertical and/or horizontal *segment* of the irrigation pyramid; or advanced memes are put undifferentiated into the water *along* with more or less primitive memes making it difficult to notice or to filter out the advanced memes.

4) Meme channels are not properly cleaned, leading to *meme pollution* with joint products of advanced memes along with poisonous or false memes, resulting in advanced memes being blocked by walls against such joint products or – in many cases – disappearing or diminished through memetic drain pipes.

5) "Gardeners" do not have the necessary *skills to recognize*, absorb or apply advanced memes.

6) Higher up in the pyramid various *meta-memes* can be inserted into the knowledge water, inducing various *illlusions*:

a) The meta-meme of *secrecy*, passing *zero* information about the fact of the advanced meme having been created except for a privileged circle.

b) The meta-meme of *denial* of the advanced meme having been created.

c) The meta-meme of *reduction*, flattening the advanced meme to just a variant of an ordinary, well-known meme.

d) The meta-meme of *inversion*, twisting the advanced scientific meme into a *non*-scientific or *anti*-scientific meme.

e) The meta-meme of *gluing*, linking the advanced meme to a meme that gardeners automatically tend to resist because of their memetic immunity system.

Such restrictions and combinations of them (which tend to be mutually reinforcing) may very well lead to the most advanced memes of state-of-the-art science not being *available* for most memetic gardeners, including most scientists, remaining *unnoticed* by them, being *unabsorbed* by them, or being *repelled* as falsely considered *non*-scientific by them (cf. Johansen 2007: 44-46, 77-82).

Among these six restrictions, only the first one is of *substantivistic* nature, *inherent* to science itself. In the present global ecology of scientific memes this restriction is *not* severe, since sustainable high technology from superior science *has* been created, as judged from solely inherent and substantivistic scientific criteria. It is rather obvious, without taking the space to inspect and display this in systematic and convincing detail, that the *other* five kinds of restrictions, *not* inherent to science itself, nevertheless are rather *severe* in the present situation. Hence, state-of-the-art is that implementation of sustainable industrial processing at a global scale is mainly obstructed, not by lack of achievements in advanced science and technology, but by various antagonistic *cultural* factors *external* to science itself.

Thus, we confront the striking paradox that while «everybody» apparently agrees about "sustainable industrial processing" at a global scale as a worthwhile goal to strive for, and as a rather urgent undertaking, it appears as a brute fact that the superior science and technology *capable* to achieve this ecological goal, so far, for the most part, is being rather brutally *obstructed* or fiercely *opposed* by non- or anti-scientific cultural factors, much connected to scientific ignorance, but not unlikely also due to some influence from significant segments of humans with inclinations of even less virtue.

Considering this striking paradox and the various complexities involved in the overall situation, far above the head and beyond the memetic belief horizon of most scientists and laymen, one may still regard continued progress

of hadronic mechanics and technology as providing a privileged track to *cut through* the jungle of cultural obstructions and *open* the road to sustainable industrial processing at a global scale. However, for such success, the *cultural* "battle" may show even more important than continued scientific and technological progress.

When contemplating the broader and complex scenario, the remarkable achievements of hadronic mechanics and related technological inventions (with Ruggero Maria Santilli as not only the initiating scientist, but a scientist still steadily spearheading further progress in hadronic theory and technology), suggest the necessity of a highly *delicate balance* to (still) be performed with respect to powers that be, whether human or beyond human. The challenges implied in such balancing are not likely to be imagined by most scientists who do not have much background to overview the involved complexities. These challenges experienced at the personal level by the revolutionary scientist, amplify when we step up to consider the rather urgent need for implementation of revolutionary science from a global human interest.

When contemplating short-cut wise these complexities, the science and technology of hadronic mechanics, with Santilli as its trailblazer, may be said to constitute *the privileged interface* between on the one hand the clandestine avant-garde science and technology with possible alien connections, and on the other hand the possible implementation of even more avant-garde science into ecofriendly high-technology in benefit for the world at large.

Science has always surpassed science fiction.
(Ruggero Maria Santilli)

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